ENVRI[plus] DELIVERABLE

D11.2

Plan for sustained multi-year planning of Oceanographic Vessels for the Environment European Research Infrastructures

WORK PACKAGE 11 – NEW CONCEPTS AND TOOLS FOR PHYSICAL ACCESS

LEADING BENEFICIARY: IFREMER

Author(s):	**Beneficiary/Institution**
Jean-François Rolin	IFREMER
Valérie Mazauric	IFREMER / EUROFLEETS2
Juanjo Dañobeita	EMSO / CSIC (outside partnership)
Mick Gilooly	EMSO / Marine Institute (outside partnership)
Olivier Quedec	IFREMER / ERVO
Jan Borre Orbaek	SIOS / Research Council of Norway

Accepted by: Abad Chabbi (WP 11 leader)

Deliverable type: REPORT

Dissemination level: PUBLIC

Deliverable due date: 29.10.2016/M18

Actual Date of Submission12.01.2018 /M33 (DELAY REQUESTED)

ABSTRACT

A comparison between the needs of Research Infrastructures in Europe (ICOS, EUROARGO, EMSO/FixO3, SIOS, EMBRC, JERICO) and the capacities of the European oceanographic fleets has been performed. It uses the 2017 data base of research vessels (area of operation, capacities and size, working gears and instruments…) established by EUROFLEETS2 I3 project. It includes all the vessels even when they are not under the flag of a EUROFLEET partner.

The result is promising and shows that if established a few years in advance, a plan of suggested use of the European vessels may be proposed to the RIs able to define their needs.

The follow up of this study may be envisaged through the possible continuation of EUROFLEETS, an intermediation activity by the ENVRI legacy and in any case thanks to the will of the ship operators unformal group ERVO who supported the orientations of the present deliverable.

Project internal reviewer(s):

Project internal reviewer(s):	**Beneficiary/Institution**
Ari Asmi	University of Helsinki
Sabine Philippin	CNRS

Document history:

Date	**Version**
27.10.2016	Draft for information of the coordination
2.06.2017	Sent to marine domain advisers (ERVO and EUROFLEETS) and SIOS
11.01.2018	Accepted by Abad Chabbi

DOCUMENT AMENDMENT PROCEDURE

Amendments, comments and suggestions should be sent to the Authors (Jean-François Rolin Jean.Francois.Rolin@ifremer.fr and Valérie Mazauric Valerie.Mazauric@ifremer.fr).

TERMINOLOGY

A complete project glossary is provided online here:
https://confluence.egi.eu/pages/viewpage.action?pageId=14452608

Deliverable specific Terminology/Glossary can be found at the end of this document.

PROJECT SUMMARY

ENVRIplus is a Horizon 2020 project bringing together Environmental and Earth System Research Infrastructures, projects and networks together with technical specialist partners to create a more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe. It is driven by three overarching goals:

1) Promoting cross-fertilization between infrastructures,
2) Implementing innovative concepts and devices across RIs,
3) Facilitating research and innovation in the field of environment for an increasing number of users outside the RIs.

ENVRIplus aligns its activities to a core strategic plan where sharing multi-disciplinary expertise will be most effective. The project aims to improve Earth observation monitoring systems and strategies, including actions to improve harmonization and innovation, and generate common solutions to shared many information technology and data related challenges. It also seeks to harmonize policies for access and provide strategies for knowledge transfer amongst RIs. ENVRIplus develops guidelines to enhance transdisciplinary use of data and data-products supported by applied use-cases involving RIs from different domains. The project coordinates actions to improve communication and cooperation, addressing Environmental RIs at all levels, from management to end-users, implementing RI-staff exchange programs, generating material for RI personnel, and proposing common strategic developments and actions for enhancing services to users and evaluating the socio-economic impacts.

ENVRIplus is expected to facilitate structuration and improve quality of services offered both within single RIs and at the pan-RI level. It promotes efficient and multi-disciplinary research offering new opportunities to users, new tools to RI managers and new communication strategies for environmental RI communities. The resulting solutions, services and other project outcomes are made available to all environmental RI initiatives, thus contributing to the development of a coherent European RI ecosystem.

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1 INTRODUCTION AND METHODOLOGY

Within the work package 11 of ENVRIPLUS, the main objective is to promote the use of Research Infrastructure platforms through exploring and promoting synergies of joint observation sites, crosscutting research, and trans-national access programs. This implies, among other things, to come up with sustained models to facilitate effective future access.

European Research fleets are composed of a range of Research Vessels of various sizes and capacities operating all over the European sea basins and world's seas. European Research Vessels and their associated equipment represent key infrastructures which contribute to the EU international leadership in marine, environmental and climate research. Owned by the different nations, they are mainly operated using national funds and their access managed through mechanisms which vary from country to country. This can limit optimal access by European researchers[1]. Separately, the ESFRI projects requiring ship-time need a multi-year plan for their use of the research fleets.

This Deliverable aims to link the Research Infrastructure projects requiring ship-time with available resources, so allowing to further develop synergies and collaboration in the future.

After succinctly describing i) the existing networks or groups enabling ship operators to interact and collaborate and ii) how the two EUROFLEETS initiatives funded by the EC have contributed to further develop cooperation and facilitate access to a group of Research Vessels, a state of potential ship-time availability based on the inventory of 102 European Research Vessels is presented. A state of the offer based on ships of opportunity used for scientific research is also addressed, as an alternative to the use of oceanographic research vessels.

Then, this study focuses on the needs in ship-time of selected Research Infrastructures, taking into account EMSO deployment and maintenance, SIOS cruise plans, EMBRC station plans and needs of other ESFRI project. EUROARGO deployments and ICOS Marine needs rely mainly on ship of opportunity agreements. The study was implemented using a questionnaire (see Appendix 5)[2] sent to some environment (or environment related) Research Infrastructures to collect detailed needs of their operations relative to oceanographic vessels, with among others the following questions:

- Location of operation;
- Size of the required ship;
- Technical capacities needed on board;
- Number of ship days needed for each operation;
- Frequency of the need during the next 10 years.

On the basis of collected information, a five-step method has been elaborated, with the objective to propose to each Research Infrastructure, a list of vessels that might be suitable for

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[1] *See analysis of the context in the H2020 call – « Integrating and opening research infrastructures of European Interest » H2020-INFRAIA-2018-2020.*

[2] *The full reply to the questionnaire by the RI responsible persons is stored in a separate document called "Synthesis of questionnaires - Access to the European oceanographic fleets by large research infrastructures". For ethical reasons, the access to this document is restricted to the project. It will be part of the legacy of ENVRIPLUS and made available to future used of the D11.2 method.*

their identified marine operations. This method is based on the use of EUROFLEETS2 and EMSO Preparatory Phase (PP) databases. The principle of this method is to successively apply filters on these databases in order to refine the search of oceanographic research vessels.

2 EUROPEAN RESEARCH FLEETS: EXISTING NETWORKS AND INITIATIVES FOR MORE COLLABORATION AND COORDINATION AT EUROPEAN LEVEL

2.1 Background

Research Vessels (RVs) are crucial infrastructures for marine sciences and the collection of marine data from the coastal areas to the deep waters of the oceans. Although they are commonly named as "Research Vessels", they serve the needs of a wide range of activities and, depending on management and structuration schemes at national level, their activities are not always strictly limited to academic research purposes. In many countries, Research Vessels are also involved in public service missions such as monitoring programmes for fishery or hydrography surveys; some of them ensure as well logistical missions in remote areas, notably as support to polar stations.

Although it is generally considered that Global or Ocean RVs are large-size and more capable infrastructures and that Coastal RVs are of smaller size, RVs are commonly classified in 4 to 5 categories with definitions not directly linked to the size of the ship but more reflecting how the infrastructure is used, i.e. for activities at local, coastal, regional, ocean or global scales.

The present section aims at providing an overview of i) **existing networks** such as the European Research Vessel Operators (ERVO) and International Research Ship Operators (IRSO) groups allowing ship operators to share knowledge and best practices, ii) **agreements** such as implemented by the Ocean Facilities Exchange Group (OFEG) and aiming to optimize the scheduling of RVs and equipment of involved ship operators through barter mechanisms and iii) **the EUROFLEETS and EUROFLEETS2 initiatives** funded by the European Commission and bringing together European ship operators in order to enhance the cost-effective use of their facilities and promote a better coordination of European research fleets.

2.2 Ship operators networks

2.2.1 The ERVO forum

ERVO website: http://www.ervo-group.eu/np4/home

The European Research Vessel Operators (ERVO) started as an initiative of the Marine Board of the European Science Foundation when, at its 1999 Annual General Meeting, the ESF-Marine Board decided to initiate an action to promote the co-ordination of small to medium sized research vessel operators in Europe. Following a preliminary meeting of the European Research Vessel Operators (ERVO) group, held in December 1999, research vessel managers/operators so decided to form a flexible forum which would meet annually to share experiences of common interest, to explore opportunities for co-operation between RV managers and to define the scope for such cooperation.

In total, eighteen annual meetings were held all around Europe since 1999. The success of the ERVO group can be measured through the number of regularly participating countries, risen from 7 to 18 progressively.

ERVO meetings address common issues/problems that affect research vessel operators for the purpose of identifying solutions for improving services to the scientific community and developing best practice in the operation of Research Vessels. Members present their National Reports on activities, including any future plans for acquisitions/upgrades. Presentations on new vessel builds are invited and a number of special topics discussed at each meeting.
The ERVO meetings also provide an opportunity for RV Managers to exchange information on their national fleets, highlighting trends in the requirements for sea-going vessels and new technological developments for RV operations.

The Terms of Reference of the ERVO Group have been adopted in 2011 and updated in 2016. An Agreement between EurOcean Foundation and ERVO has been signed in April 2014 for website maintenance, communications aspects and management of members' fees. The EUROFLEETS projects (see section 2.3 of this report) regularly has reported on their work progress at the ERVO meetings held since 2009 and, since 2012 ERVO is a permanent invitee to EUROFLEETS meetings.

Furthermore, in 2017, it was decided to add a half-day meeting before the annual ERVO meeting, concerning the region where the meeting takes place. The objectives are: to foster more regional cooperation among ERVO members, to present issues and opportunities.

In the future, if it is decided to formalize a European fleet coordination, ERVO could play this role but this will probably require the group to move to a more formal organization.

It shall be noted that, at the 18th ERVO annual meeting held in Rhodes (Greece), ENVRIPLUS was introduced to the Assembly, with particular focus on the ENVRIPLUS WP11 objectives on the needs to implement European RIs access to oceanographic vessels. The presentation "European long-term needs to support Environmental (Marine) Research Infrastructures by means of Oceanographic Vessels: Challenge and opportunity to enhance specific cooperation actions" done by J. Dañobeitia (CSIC, Spain) is available on the ERVO website.

2.2.2 The IRSO forum

IRSO website: http://www.irso.info/

The International Research Ship Operators (IRSO) forum is a group of research ship operators representing 49 organisations from 30 countries who manage over 100 of the world's leading marine scientific research vessels. **Ship operators from 17 European countries are members of the IRSO forum**. Previously known as the International Ship Operators Meeting (ISOM), IRSO was founded in 1986 and is attended voluntarily with meetings hosted by and in participating countries.

IRSO members gather annually (September/October) to share information and best practices regarding design, management and operation of research ships and associated scientific equipment, in order to better support the marine scientific community's research efforts at sea.
Main topics and objectives of the annual agenda are: i) Best practice design and operation of research ships and associated scientific equipment, ii) The exchange of ship time and equipment between countries, iii) Benchmarking and co-operation in support of marine research and iv) Developments in national research fleets. IRSO initiates projects of common interest to its members. For example, it has developed a Code of Conduct for Marine Scientific Research Vessels and contributed to the founding of the OCEANIC research ships database at the University of Delaware. IRSO also sponsors workshops and working groups: for example, the biannual International Marine Technician's Workshop (INMARTECH).

IRSO has close links with and is attended by research vessel groups such as the European Research Vessels Operators (ERVO), the Ocean Facilities Exchange Group (OFEG) and the University-National Oceanographic Laboratory System (UNOLS).

At the occasion of its 2016 IRSO meeting held in Capri (Italy), ENVRIPLUS was introduced, with focus on the needs to implement access to research vessels in the presentation "Medium to Long-term needs for Research Vessels supporting Ocean Observing System Infrastructures" by J. Dañobeitia (CSIC, Spain).

2.2.3 Agreements: the OFEG group and its bartering experience

OFEG website: http://www.ofeg.org

The Ocean Facilities Exchange Group (OFEG) represents Europe's leading oceanographic research organizations and provides a forum to consider barter exchange and co-operation opportunities for the Global and Ocean Class research fleet. OFEG is composed of 6 members, namely CSIC (Spain), IFREMER (France), IMR-UoB (Norway), BMBF (Germany), NERC (UK) and NIOZ (Netherlands).

The main objective of OFEG consists of exchange of ship time and of major equipment based on 'bartering' without money-exchange; joint cruises exchange based on value points according to scientific capacity as agreed between members. This takes significant advantages as the access to a wider range of facilities, and the access to the marine areas beyond the scope of an alone country. At the same time, it shows a more efficient use of ship time, reducing the costs and time on long passages.

OFEG also consists in mutual help when equipment gets lost, recovery of drifting moorings, when within reach; en-route servicing and turn-around of partners' moorings, combined sampling and measurements for partners.

OFEG meets twice a year for fine tuning of joint cruise planning and cruise scheduling, such as geographical cruise schedules.

The OFEG's activity is regularly reported at annual ERVO and IRSO meetings.

In parallel to the OFEG group, it was decided to create a second group focusing on technical aspects, **the OFEG-TECH group**, to aid the development of OFEG from a pure ship barter organization to one that is also capable of delivering state of the art marine scientific facilities across all OFEG platforms, through interoperability of large equipment, adoption of common working practices, harmonized mechanisms, protocols and tools.

2.3 Projects: the EUROFLEETS initiatives to foster coordination of European research fleets and provide access to European RVs

Built upon the recommendations of the *Ocean Research Fleets Working Group* (OFWG) in the ESF-Marine Board Position Paper 10 "European Ocean Research Fleets – Towards a Common Strategy and Enhanced Use", the **EUROFLEETS(1) (2009-2013) and EUROFLEETS2 (2013-2017) projects** funded by the European Union (EU contribution, 16.2 M€ in total) under the 7th Framework Programme have aimed to build an alliance of marine research centres and to bring together marine research fleets owners and operators in order to enhance their coordination and to promote the cost-effective use of their facilities.

As *Integrated Infrastructure Initiatives* (I3), these two projects have been structured in three complementary and strongly connected activities : 1) **Trans National Access (TNA)** to offer access to a group of European Research Vessels and mobile equipment on basis of scientific excellence, 2) **Joint Research (JRA)** to collaborate on technological developments (ship design, software, underwater vehicles and payloads, etc.) for larger inter-operability and 3) **Networking (NA)** to develop strategic perspectives and schemes for better coordinated European Research fleets, including the polar component. The training of the next generation of marine scientists was also a key priority for both EUROFLEETS projects.

Under an enlarged partnership in EUROFLEETS2 (31 marine institutes, universities, foundations and SMEs from 20 European countries) including 20 Research Vessel operators, a total of 22 Research Vessels (RVs) (8 Global/Ocean RVs and 14 Regional ones) were made accessible in a wide geographical sector covering not only all European eco-regions but also some polar areas in Arctic and Antarctic. The proposals submitted to the 8 calls for ship-time organized since 2009 have shown that a significant scientific demand from a wide and diverse community of users exists for TNA such as implemented in EUROFLEETS projects, in particular for researchers from less or non-equipped countries, for early career scientists, for research programmes requiring multidisciplinary expertise and skills, or to access remote areas that are impossible to access using national infrastructures. Moreover, through its innovative “Super-integration” call aiming to identify a flagship project requiring the mobilisation of TNA RVs and nationally funded RVs, together with other research infrastructures, EUROFLEETS2 funded a multi-platform experiment, highlighting the strong synergies that can be so created between research programs receiving various funding sources. With a total of 104 scientific proposals submitted within the projects’ calls, the shared evaluation system developed under the umbrella of EUROFLEETS projects has proven to be efficient and its criteria should be used as a baseline for future evaluation of European calls for ship-time. In total, EUROFLEETS projects have funded 41 cruises representing more than 400 days at sea.

On more strategic aspects, through the analysis of the current status of European Research fleets, the EUROFLEETS projects contribute to the development of a common strategic vision. Concerning Polar Research fleets, EUROFLEETS2 focused on determining the available capacities of Polar RVs, comparing that with the scientific demand, and establishing models for optimisation of these Research fleets. One of proposed models aims to build an “Arctic Research Icebreaker Consortium” and is the subject of a proposal led by Germany and submitted to the calls for European Research Infrastructures in the EU H2020 Work Programme 2016-2017.

Furthermore, EUROFLEETS2 issued several recommendations to make steps towards better coordinated European Research fleets, promoting i) at national level, an integrated approach for the ship scheduling, and ii) at European level, the creation of a Coordination System of European Research Fleets, with a permanent office, to facilitate cooperation and operational coordination, and to develop a structured link between Research fleet operators and initiatives/projects of common interest such as the European Ocean Observing System (EOOS), the EMSO-ERIC, the Joint Programming Initiatives…. Based on the successful results of the TNA activity in both projects, it was also recommended to further develop TNA mechanisms through funding/co-funding at both EU level and national levels in order to meet the needs of user’s communities and support existing and future initiatives.

ERVO and OFEG chair persons were permanent invitees to annual EUROFLEETS2 General Assemblies.

The EUROFLEETS2 projects ends in June 2017. Opening the way to the preparation of the 3rd proposal, a “Research Vessels” topic has been included in the H2020 2018-2020 Work Programme.

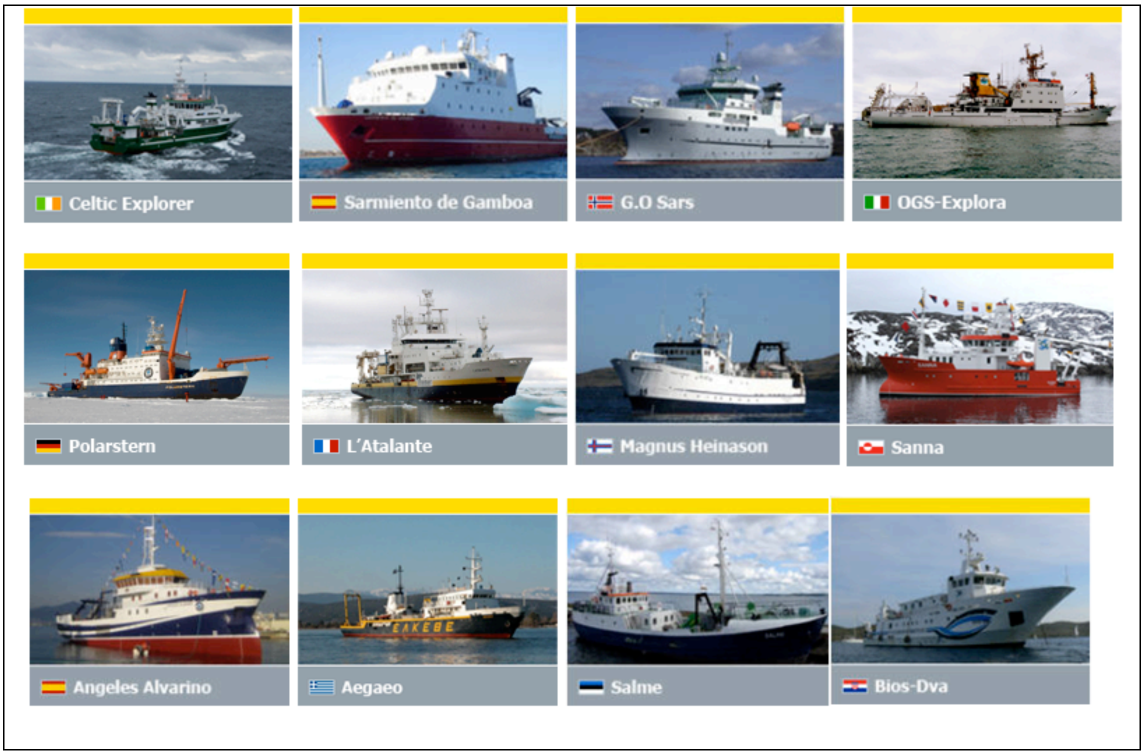

Figure. 1 Example of Research Vessels involved in the EUROFLEETS2 project for transnational access

3 EUROPEAN RESEARCH VESSELS AND EQUIPMENT: STATE OF THE OFFER IN THE EUROPEAN RESEARCH AREA (ERA)

The proposed approach is built upon the follow-up of the European Research fleets status carried out in the FP7 EUROFLEETS projects, and more particularly using the results of a survey recently conducted within the EUROFLEETS2 project. This survey aiming to identify resources available at Regional level is described in Appendices 1 to 3 of this report (Appendix 1 – Preliminary definitions to use the EUROFLEETS2 database, Appendix 2 - Inventory of European Research Vessels, with their geographical areas of operation (source: EUROFLEETS2 project), Appendix 3 - Technical capacity of European Research vessels (source: EUROFLEETS2 project)).

Moreover, a similar work has been done by the EMSO Preparatory Phase project's team to assess the possibility of some European Research Vessels in hosting and deploying submarine vehicles (see Appendix 4 - Global, Oceanic, Regional Vessels /versus scientific ROVs (source: EMSO PP – extracted from D6.3 "Sea Operation Plan" of the EMSO Preparatory Phase project).

In parallel, the ENVRIPLUS team conducted a survey of research infrastructures in order to collect their needs in terms of oceanographic vessels (Appendix 5 - ENVRIPLUS Questionnaire: need of European Oceanographic fleet).

The approach proposed here aims to link the ship-time needs collected for these surveyed research infrastructures with the resources described in the EUROFLEETS2 and EMSOdev databases. It is based on a five-step method using the EUROFLEETS2 and EMSO PP databases, and whose objective is to determine a list of relevant vessels answering the needs of the Research Infrastructures. This method is illustrated in the following concrete case, the PIRATA France cruises.

3.1 Presentation of the method to identify research vessels

3.1.1 Step 1: Collect of the RI needs

Firstly, it is necessary to collect the need of the selected RI according to the following characters:

1) Desired location of operation;
2) Capacity of the vessel;
3) Type of underwater operation or measurements required;
4) Frequency of operation required.

Detail of the need of the PIRATA RI:

The PIRATA area is situated in the tropical Atlantic, which has been maintaining for about 20 years, 18 meteo-oceanic buoys. The buoys are equipped with meteo sensors and oceanic parameters sensors from the surface down to 500 meters. A weight is at the bottom with a releaser around 50 m above. Yearly dedicated cruises are necessary to replace all buoys. A vessel with about a capacity of 10 scientists or technicians and with about a length of 60 meters is essential to realize these cruises. The essential materials onboard, required by the RI for such cruises, are

- Winches for deployment of deep moorings;
- Hydrological winch for CTDO2/LADCP profiles (0-2000 m minimum);
- Humid and dry laboratories to analyse samples;
- Thermosalinograph;
- Vessel mounted ADCP;
- Rubber boat: one need to retrieve met sensors on the buoys before their recovery onboard;
- Eventually, acoustic sensors and fluorimeter.

3.1.2 Step 2: Area filter

Once the need of the Research Infrastructure is known (e.g. place of operation, vessel capacity, type of measurement desired), successive filters will be applied to the EUROFLEETS2 and EMSO PP database (just for the use of the method as up to now, ROVs have not been required by PIRATA) in order to determine which vessels could match the demand from the RI.

The second step of this method consists on applying a first filter on the wishes area of operation. According to the information given by the PIRATA RI, the need concerns the tropical Atlantic area. After applying the first filter on the EUROFLEETS2 database, we get 24 possible vessels, which are listed below:

Eurofleets

		1960 1970 1980 1990 2000 2010 2020 2030	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technician	Other oceans Atlantic ocean except european areas
FRANCE	Antéa	Antea	1995	22	R	IRD	34,95	10	1
	Beautemps-Beaupré	Beautemps-Beaupré	2002	15	O	French Navy	80,64	25	1
	L'Atalante	L'Atalante	1990	27	G	Ifremer	84,6	29	1
	Marion Dufresne	Marion Dufresne	1995	22	G	IPEV	120,5	110	1
	Pourquoi pas?	Pourquoi pas?	2005	12	G	Ifremer	107,7	40	1
GERMANY	Maria S. Merian	Maria S. Merian	2006	11	G	LDF	94,8	22	1
	Meteor	Meteor	1986	31	G	LDF	97,5	30	1
	Polarstern	Polarstern	1982	35	G	AWI	118	55	1
	Poseidon	Poseidon	1976	41	O	GEOMAR	60,7	11	1
ITALY	OGS-Explora	OGS-Explora	1973	44	O	OGS	72,63	24	1
IRELAND	Celtic Explorer	Celtic Explorer	2002	15	O	MI	65,5	19-21	1
NORWAY	Dr. Fridtjof Nansen	Dr. Fridtjof Nansen 2017 New Fridjof Nansen	1993	24	O	IMR	56,8	20	1
	G.O.Sars	G.O.Sars	2003	14	O	IMR	77,5	30	1
	Lance	Lance 2016 Konprins Haakon	1978	39	O	NPI	60,8	25	1
NETHERLANDS	Pelagia	Pelagia	1990	27	G	NIOZ	66	15	1
PORTUGAL	Almirante Gago Coutinho	Almirante Gago Coutinho	1985	32	R	IH	68,2	15	1
	Arquipelago	Arquipelago	1993	24	C	IMAR/DOP-UAC	25	6	1
	Dom Carlos I	Dom Carlos I	1989	28	R	IH	68,7	15	1
	Noruega	Noruega	1978	39	R	IPIMAR	47,5	12	1
SPAIN	Hesperides	Hesperides	1991	26	G	CSIC	82,5	37	1
	Vizconde de Eza	Vizconde de Eza	2000	17	R	SGPM	53	16	1
UNITED KINGDOM	Discovery	Discovery	2013	4	G	NERC	99,7	28	1
	James Clark Ross	James Clark Ross	1991	26	G	BAS-uk	99,04	50	1
	James Cook	James Cook	2006	11	G	NERC	89,2	32	1

24 ships available for this location

Table. 1 List of vessels sailing in Atlantic Ocean

3.1.3 Step 3: Size vessel filter

The third step of this method consists in applying, to this first list, a second filter on the size of the boats with the following features: a capacity of 10 scientists or technicians and with about a *length of 60 meters.* After applying the second filter, we get 19 possible vessels, which are listed in the table below:

Eurofleets

		1960 1970 1980 1990 2000 2010 2020 2030	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technician	Other oceans Atlantic ocean except european areas
France	Beautemps-Beaupré	Beautemps-Beaupré	2002	15	O	French Navy	80,64	25	1
	L'Atalante	L'Atalante	1990	27	G	Ifremer	84,6	29	1
	Marion Dufresne	Marion Dufresne	1995	22	G	IPEV	120,5	110	1
	Pourquoi pas?	Pourquoi pas?	2005	12	G	Ifremer	107,7	40	1
GERMANY	Maria S. Merian	Maria S. Merian	2006	11	G	LDF	94,8	22	1
	Meteor	Meteor	1986	31	G	LDF	97,5	30	1
	Polarstern	Polarstern	1982	35	G	AWI	118	55	1
	Poseidon	Poseidon	1976	41	O	GEOMAR	60,7	11	1
ITALY	OGS-Explora	OGS-Explora	1973	44	O	OGS	72,63	24	1
IRELAND	Celtic Explorer	Celtic Explorer	2002	15	O	MI	65,5	19-21	1
	G.O.Sars	G.O.Sars	2003	14	O	IMR	77,5	30	1
	Lance	Lance 2016 Konprins Haakon	1978	39	O	NPI	60,8	25	1
NETHERLANDS	Pelagia	Pelagia	1990	27	G	NIOZ	66	15	1
PORTUGAL	Almirante Gago Coutinho	Almirante Gago Coutinho	1985	32	R	IH	68,2	15	1
	Dom Carlos I	Dom Carlos I	1989	28	R	IH	68,7	15	1
SPAIN	Hesperides	Hesperides	1991	26	G	CSIC	82,5	37	1
UNITED KINGDOM	Discovery	Discovery	2013	4	G	NERC	99,7	28	1
	James Clark Ross	James Clark Ross	1991	26	G	BAS-uk	99,04	50	1
	James Cook	James Cook	2006	11	G	NERC	89,2	32	1

19 ships available for this location and capacity

Table. 2 List of vessels sailing in Atlantic Ocean and having a length about of 60 meters

3.1.4 Step 4: Technical capacities filter

The fourth step of this method consists in determining, from the list of already identified vessels, which ones are able of carrying out the measurements desired by the PIRATA Research Infrastructure.

The major measurement equipment required by the PIRATA RI is heavy moorings capabilities, CTD Rosette, ADCP and humid and dry laboratories, which correspond to the technical capacities Phys 5, Phys 3, Phys 1 and Lab, respectively, in the EUROFLEETS2 database.

After applying the filter on technical capacities, the EUROFLEETS2 database tool have allowed to identify 13 possible vessels for the PIRATA cruises needs.

		Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technicians	Technical capacity: Phys 1	Phys 3	Phys 5	Lab
France	Beautemps-Beaupré	2002	15	O	French Navy	80,64	25	x	x	x	3
	L'Atalante	1990	27	G	Ifremer	84,6	29	x	x	x	8
	Marion Dufresne	1995	22	G	IPEV	120,5	110	x	x	x	x
	Pourquoi pas?	2005	12	G	Ifremer	107,7	40	x	x	x	5
GERMANY	Maria S. Merian	2006	11	G	LDF	94,8	22	x	x	x	13
	Meteor	1986	31	G	LDF	97,5	30	x	x	x	18
	Polarstern	1982	35	G	AWI	118	55	x	x	x	13
ITALY	OGS-Explora	1973	44	O	OGS	72,63	24	x	x	x	4
IRELAND	Celtic Explorer	2002	15	O	MI	65,5	19-21	x	x	x	4
NORWAY	G.O Sars	2003	14	O	IMR	77,5	30	x	x	x	10
NETHERLANDS	Pelagia	1990	27	G	NIOZ	66	15	x	x	x	4
UNITED KINGDOM	Discovery	2013	4	G	NERC	99,7	28	x	x	x	5
	James Cook	2006	11	G	NERC	89,2	32	x	x	x	6

13 ships available for this location, capacity and technical capacities

***Phys 1**: ADCP*
***Phys 3**: CTD Rosette Deployment*
***Phys 5**: Heavy moorings capacity (> 1000 m)*
***Lab**: Laboratory (number)*

Table. 3 List of vessels sailing in Atlantic Ocean, with a minimum length of 60 meters and having the required technical capacities for the PIRATA cruises

3.1.5 Step 4: Submersible vehicles filter

In the case of the PIRATA cruises, no submersible vehicle was requested on board. If this had been the case, a fourth filter could be applied, using the EMSO PP database, in order to verify the feasibility of using a ROV on the 13 selected vessels and thus, allows to further refine the search.

To continue our example, one would imagine that the PIRATA Research Infrastructure finally needs a submersible vehicle that can go to a depth of 3000 meters. The submersible vehicle filter applying on our vessel list gives us a list of at least six vessels that can host and deploy such submarine vehicle. Possibilities are given in the following table.

RV	Country	Holland 3000m	Quest 4000m	Victor 6000 6000m	Isis 6500m	IEO 2000m	Aglantha 2000m	Max Rover 2000m	Kiel 6000 6000m	ROV Phoca	MeBo
Beautemps-Beaupré											
L'Atalante	France										
Marion Dufresne	France										
Pourquoi pas?	France										
Maria S Merian	Germany										
Meteor	Germany										
Polarstern	Germany										
OGS Explora	Italy										
Celtic Explorer	Ireland										
GO Sars	Norway										
Pelagia	Netherlands										
Discovery	UK										
James Cook	UK										
	Proven deployment on RV										
	Possible deployment of ROV with minor modifications										
	To be queried to vessel operator – no obvious capacity to deploy ROV										
	Cannot deploy ROV										
	No information available										

Table. 4 Ability of the 8 selected vessels to host and deploy ROVs (source EMSO PP)

3.1.6 Synthesis of the method

This method does not allow to formally identify the vessel that can be used by the PIRATA Research Infrastructure but it allows to give several relevant tracks in order to find a vessel to realise its goals.

This method is an interesting tool to realise a first selecting among the 102 European Research Vessels identified in the EUROFLEETS2 database. Here, it has identified 6 possible vessels which could be used by the PIRATA Research Infrastructure. Among these 6 vessels, there is the R/V L'Atalante which has been already identified by the PIRATA-France Research Infrastructure to replace the R/V Antea when the number of buoys has been increased some years ago.

Table. 5 Table of synthesis of the method to identify research vessels by using EUROFLEETS and EMSO PP databases

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation**	**Size of the ship**	**Technical capacities**	**Ship days**	**Frequency**	**Filter 1 Area**	**Filter 2 Size of ship**	**Filter 3 Technical capacities**	**Filter 4 Submersible vehicle**	**Observations**
PIRATA RI Cruises	Tropical Atlantic	10 science berths; > 60 m	Phys 5 Phys 3 Phys 1 Lab	≈70	Yearly	Antea Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Maria S Merian Meteor Polarstern Poseidon OGS-Explora Celtic Explorer Dr Fridtjof Nansen GO Sars Lance Pelagia Almirante Gago Coutinho Arquipelago Dom Carlos I Noruega Hesperides Vizconde de Eza Discovery James Clark Ross James Cook	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Maria S Merian Meteor Polarstern Poseidon OGS-Explora Celtic Explorer GO Sars Lance Pelagia Almirante Gago Coutinho Dom Carlos I Hesperides Discovery James Clark Ross James Cook	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Maria S Merian Meteor Polarstern OGS-Explora Celtic Explorer GO Sars Pelagia Discovery James Cook	L'Atalante Pourquoi pas? Maria S Merian Meteor Polarstern Celtic Explorer Discovery James Cook	

3.2 Modalities of Research Vessel access

Procedures implemented in 15 European countries (namely Belgium, Estonia, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Spain, Turkey and UK) for accessing Research Vessels were reviewed during the first EUROFLEETS project (2009-2013).

This review highlighted that existing procedures for RV management and cruise planning are different in the various European countries. Though the various management regimes are focused around the same principles, significant differences remain in timing, procedures, evaluation practices, funding etc. To foster common standard and harmonized procedures in RV management and, as a first step towards this perspective, the Project established **a set of guidelines built on collected information and addressing various aspects of the management procedures** such as 1) Ownership, 2) Management, 3) Applications, 4) Evaluations, 5) Funding, 6) Scientific equipment, 7) Ship schedule, 8) Permits and cruise preparation and 9) Cruise report. However, it is a matter of fact that management procedures have not significantly changed since the EUROFLEETS survey was implemented, it is therefore recommended to directly contact the ship operators for precise information on how to access a given ship.

Concerning the scheduling of the ships, the consultation of the cruise programme database available in the EUROFLEETS EVIOR portal and developed in partnership with POGO (http://eurofleet.maris2.nl/v_eurofleets_v1/browse_step.asp) shows that information on future and already scheduled cruises are available for a very limited number of vessels. The advanced programming for research activity is limited in most of the cases to a maximum of one-year. This lack of knowledge on the scheduling plans of research fleets, in particular at regional level, has motivated the ERVO group to organize the half-day "Regional focus" meeting in order to foster exchange of information on ship and cruise schedules (see section 2.2.1 of this report).

3.3 Routine en route operations and measurements

The national programing of the Research Vessels in Europe is organized on the principle of yearly schedule. In some cases, they are planned a few years ahead and adjusted by the operators. The various missions are devoted a proportion of the available cruise time: research cruises according to calls selecting according to scientific excellence criteria, national missions of environment monitoring, fish stock assessments, charter by contract, TNAs …

Some Research Vessel time is dedicated to technical or logistic cruises; transit between cruise sites correspond to the management skill of the operators to minimise costs for a given cruise agenda. Some of the RIs do not need complete cruises and may be served by a short allocation of ship time during a transit. They may also be satisfied by the continuous measurement of some parameters on board: these are en route operations.

4 SHIPS OF OPPORTUNITY USED FOR SCIENTIFIC RESEARCH

4.1 JCOMMOPS

The JCOMM in situ Observing Platform Support Centre (JCOMMOPS) was established by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) in 2001 based upon coordination facilities provided by the Data Buoy Cooperation Panel (including drifting and moored buoys), the Ship Observations Team (SOOP - XBT, TSG. ASAP - Atmospheric soundings from ships. VOS (Voluntary Observing Ship) - Meteorological observations from ships) and Argo profiling float programme. Synergy was therefore realised between these three global marine observational programmes, which can assist those in charge of implementing the National components of these programmes, through an integrated and international approach.

JCOMMOPS is a Central gateway, which provides support with programme planning, implementation, and operations (mainly en route operations), including information on:

1. Observational data requirements;
2. Technology, instrumentation, and costs;
3. Operational status of observing networks (e.g. identification of data sparse area);
4. Deployment opportunities (by ship and air).

It maintains information on relevant data requirements for observations in support of GOOS, GCOS and the World Weather Watch of WMO as defined by the appropriate international scientific panels and JCOMM Expert Teams and Groups and routinely provides information on the functional status of the observing system. It also encourages platform operators to share data and distribute it in real-time and gives technical assistance with satellite data acquisition, automatic data processing and Global Telecommunication System (GTS) distribution of the data. JCOMMOPS also provides a mechanism for relaying quality information from data centres and users worldwide, back to national platform operators.

JCOMMOPS acts as a focal point for implementation and operation of relevant observing platforms. The centre, which is located in Brest in France, is funded through voluntary contributions from JCOMM Member States participating in the marine observing programme and panels such as DBCP and Argo.

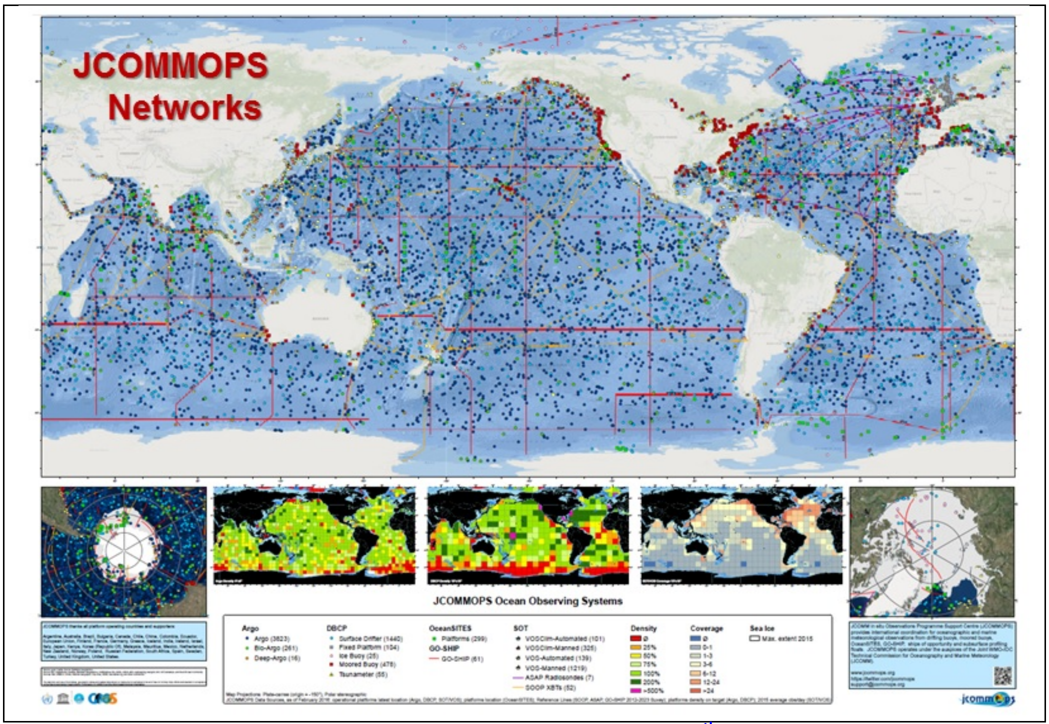

Figure. 2 Presentation of the JCOMMOPS network ([18th ERVO meeting, Juanjo Dañobeitia])

4.2 GOSUD and Copernicus oriented initiative

Global Ocean Surface Underway Data (GOSUD) is an initiative of the International Oceanographic Data and Information Exchange (IODE) of the Intergovernmental Oceanographic Commission (IOC) programme. It aims at assembling *in-situ* temperature and salinity parameters of the world ocean surface collected by a variety of ships and at distributing quality controlled datasets.

GOSUD data are provided by volunteer contributors who are willing to build freely accessible global datasets, promote standard methodologies and agree on a common data policy. The en route observations are collected from different categories of platforms such as research vessels, merchant ships but also sailing ships or cruise vessels. Whenever possible, data or data subsets are transmitted in real time.

4.3 FerryBoxes

"FerryBoxes" are automated instrument packages installed, since many years, on ships of opportunities as for example, ferry boats, which carry out regular ship cruises.

The automatic observation of oceans using buoys, piles and platforms is very expensive mainly due to -not yet solved- bio-fouling of the sensors. Indeed, marine sensors require frequent manual cleaning if a consistent data quality shall be achieved.

The main objectives of the FerryBoxes are, among others, the en route observation of physical and biogeochemical parameters along regular ship cruises, the validation of existing models (as hydrodynamic and ecosystem models) and the comparison with remote sensor measurements (www.ferrybox.org). There are ongoing activities to make all European FerryBox data available in one common European database and data portal. Information collected by the FerryBoxes is also used to supply data to the databases of ROOSes (regions of EUROGOOS) and Copernicus Marine Environment Monitoring Service (CMEMS).

The major advantage to use sensors on ferryboats is the reduction of maintenance costs of the sensors. Because ships offer enough energy and sheltered conditions inside, more complicated analyser system and more sophisticated equipment can be installed and used on board. Moreover, the information from a fixed and repeated transect is more valuable than a time series from a single location.

The following figure presents the principle of functioning of a FerryBox.

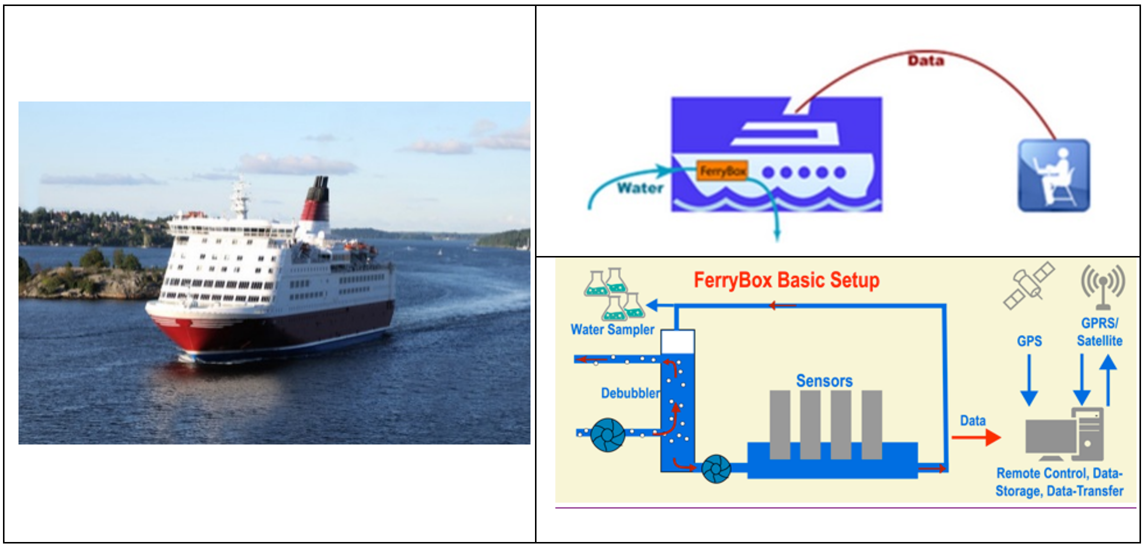

Figure. 3 Principle of the FerryBoxes

Several commercially available sensors are already totally operational in FerryBox systems. Others need major improvements before an operational use and some are only “on the horizon”.

Operational standard sensors	**Sensors that need major improvements**	**Sensor systems that are “on the horizon”**
Temperature	High precision pH	Algal species by genetic sensors
Salinity	Nutrients (NO_x, NH_3, PO_4, SiO_2)	Organic micro-pollutants by genetic sensors
Oxygen	Phytoplankton-Groups	
Turbidity	Phytoplankton and zooplankton by morphology	
pCO2 total		
Alkalinity		
Chl-a		
Fluorescence		

Table. 6 Lists of present, in improvement and future sensors implemented in FerryBox systems

Today we can list about 35 routes in Europe. There are listed and detailed in the www.ferrybox.org internet website. For each route, information is given on the operating institution, the observed parameters, the time of operation, the contact information and detailed equipment.

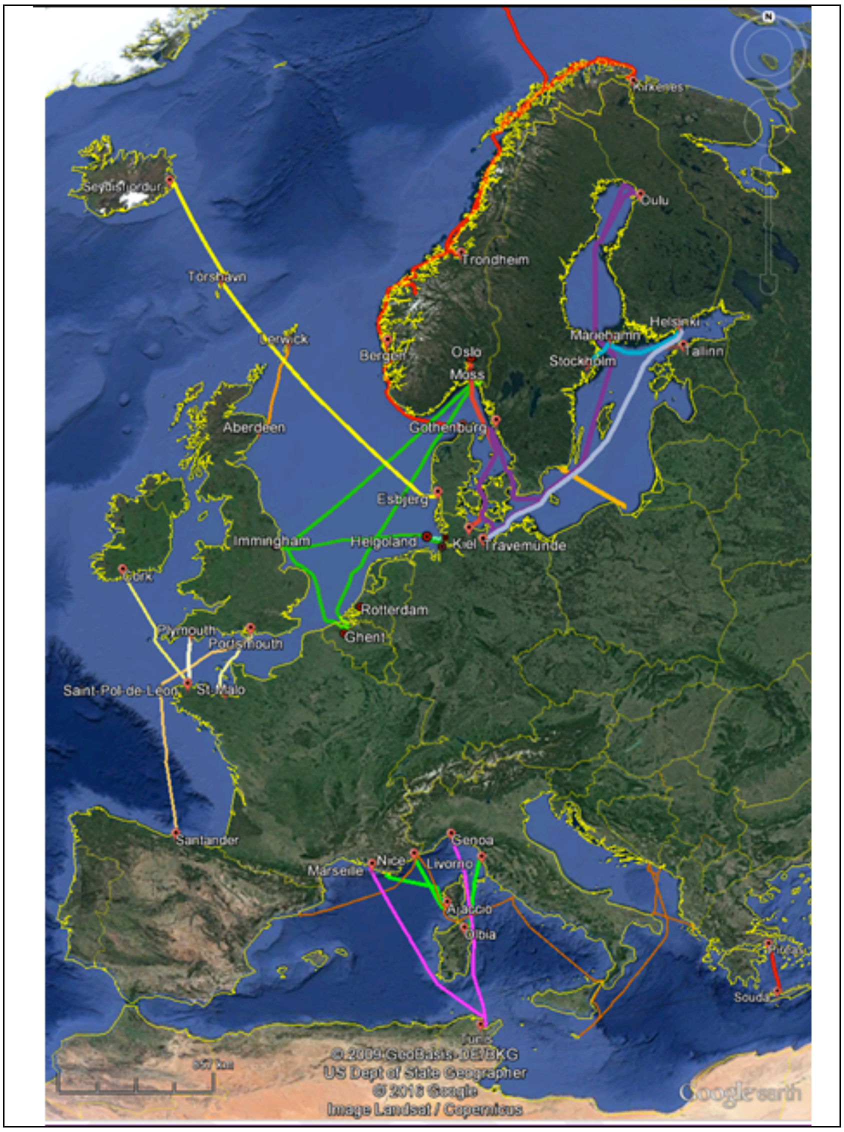

Figure. 4 Map with FerryBoxes routes in Europe (from www.ferrybox.org)

4.4 Other initiatives

The International SeaKeepers Society is an organization which supports marine science and conservation by utilizing yachts as platforms for marine research, educational outreach, and to deploy oceanographic instruments. Their efforts eliminate vessel costs and permit scientists to allocate those funds to maximize research potential.

Figure. 5 Vessels available for charter or sale

SeaKeepers collaborate with numerous organisations, academic institutions and government agencies, including the National Oceanic and Atmospheric Administration (NOAA), World Meteorological Organization (WMO) and Argo, to make ongoing oceanographic measurements with SeaKeepers Drifters and Argo floats. Collected data is used for oil spill and marine debris accumulation analyses; weather and hurricane prediction models; satellite quality control; and an overall better understanding of the marine environment. Private vessels deploy instruments along routes which are not typically traveled.

SeaKeepers coordinate the SeaKeepers DISCOVERY Yatchts Program. This initiative is comprised of scientific expeditions, instrument deployments and educational outreach events onboard private vessels

5 NEEDS OF EU SUPPORTED RESEARCH INFRASTRUCTURES

Needs of EU supported Research Infrastructures varies from one Research Infrastructure to another. Indeed, to meet their needs (mainly en route), some research Infrastructures have already planned or have already preliminary views in terms of access to oceanographic vessels, such as

- EuroARGO ERIC, which already uses research cruises or ships of opportunity to deploy ARGO profiling floats;
- ICOS OTC, which already has permanent stations and cruise plans in his Marine Integrated Carbon Observation System;
- And JERICO-NEXT, which already uses Ferry box and systems complementary to research vessels.

Some other Research Infrastructures have not yet applied permanent plans but can count on tasks performed during their ESFRI Preparatory Phases, which include Research Vessels, such as

- SIOS – Svalbard Integrated Arctic Earth Observing System;
- EMSO-ERIC, which finalized the process to be a legal entity;
- FIXO3, which includes moorings in addition to EMSO sites and some CO_2 measurements contributing to ICOS. FIXO3 activities will be merged inside EMSO-ERIC.

5.1 EUROARGO needs

The New Euro-Argo Research Infrastructure called Euro-Argo ERIC is the European contribution of the international Network Argo, constituted with 3,800 floats which measure the temperature and salinity from the surface up to 2,000 meters deep on the whole oceans. The objectives of the Euro-Argo are to provide a world-class service to the research (ocean and climate) and operational oceanography (Copernicus Marine Service) communities. Euro-Argo also aims at preparing the next phase of Argo with an extension to deeper depths, biogeochemical parameters and observations of the Polar Regions.

Float deployments are organized by the Euro-Argo ERIC and require adequate logistical support and easy access to information on research cruises for deployment opportunities. Floats can be deployed either during research cruises or either from ships of opportunity, which have been identified. In order to identify float deployment opportunities, the Euro-Argo ERIC interacts both with the Euro-Argo Members and Observers that have privileged access to their national research vessels plans, and with the Ship Coordinator of the JCOMM in situ Observing Platform Support Centre (see paragraph 4.1), funded by ARGO and located in the same building as the Euro-Argo ERIC.

5.2 EMSO/FixO3/ESONET/PIRATA needs

The European Multidisciplinary Seafloor and water column Observatory (EMSO) is a pan-European distributed research infrastructure, composed of fixed point open ocean nodes, whose scientific aims are to provide coherent long-term data sets to monitor European seas.

The EMSO-ERIC will be the legal entity in charge of coordinating and facilitating access to open ocean fixed point observatory Infrastructures in Europe. It will also be the central point of contact for observatory initiatives in other part of the world to set up and promote cooperation in this field. In addition, EMSO-ERIC will integrate research, training, and information dissemination activities on ocean observatories in Europe and to enable scientists and other stakeholders to make efficient use of a future network of ocean observatories around Europe.

EMSO observatory nodes have been or will be deployed at key locations in European seas (Figure 6), from the Arctic to the Atlantic, through the Mediterranean to the Black Sea. There are currently twelve deep-sea nodes plus four shallow water test nodes. The Integration Infrastructure Initiative FixO3 prepared the integration in EMSO of other fixed point observatories addressing more the water column researches (Figure 7).

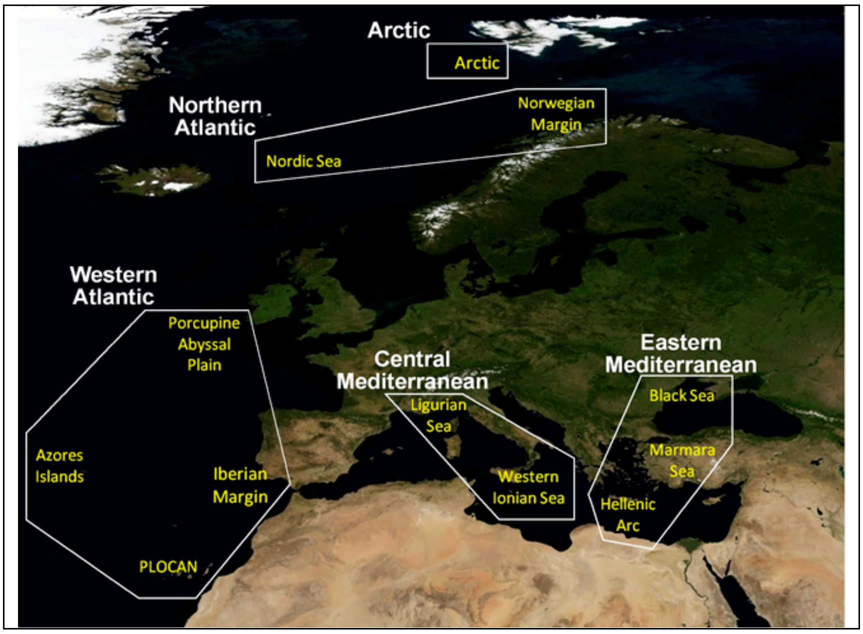

Figure. 6 Nodes and test sites of the EMSO-ERIC Infrastructure

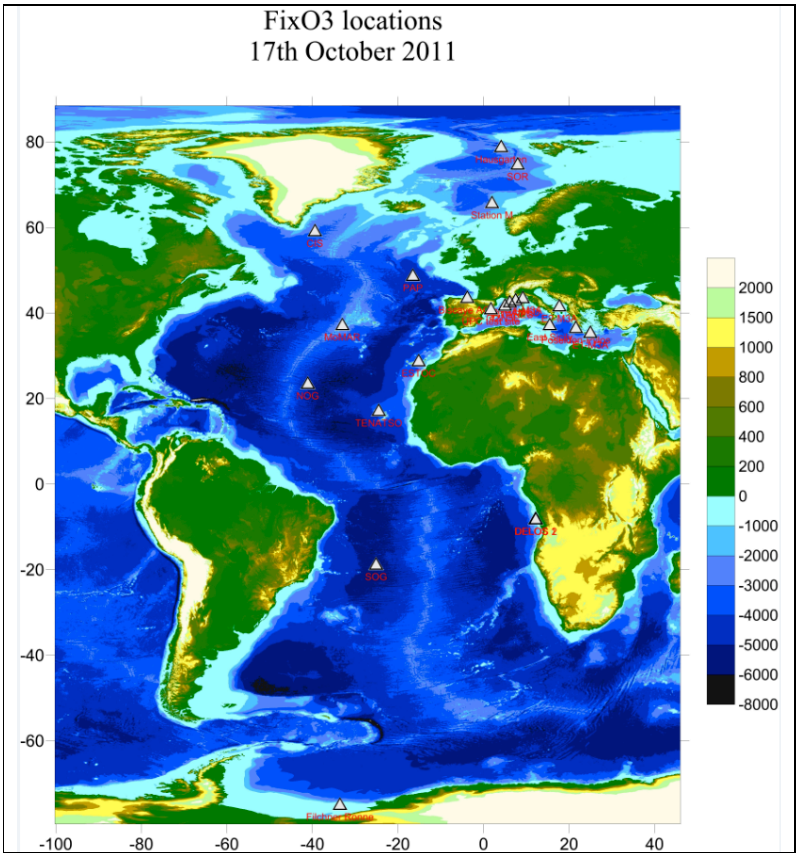

Figure. 7 FiXO3 stations

Additional challenges for EMSO-ERIC regarding standardization and data exchange came up as a result of intensified cooperation with other environmental infrastructures within an international multidisciplinary network including observatory operators from the United States, Canada, Japan and Australia. These standardization and harmonization efforts are ongoing within the framework of EC projects (e.g. ENVRIplus and COOP+).

EMSO-ERIC tackles to develop cross collaboration with other ESFRI RIs (EMBRC, EPOS, KM3Net and SIOS), established or incoming ERICs (EURO-ARGO, ICOS and LIFEWATCH) and new entry in the ESFRI roadmap 2016 (ACTRIS, DANUBIUS RI). EMSO-ERIC also participates in many EU projects (e.g. FixO3, MARsite, INDIGO, ATLANTOS, NEXOS, JERICO-NEXT, and EMSODEV) and has links with other EU initiatives such as EUROFLEETS-2, SeaDataNet, KM3Net and EMODnet.

Recently, EMSO-ERIC emphasized the importance, evolution and coordination of fleets and ROV/AUV facilities to support seafloor observatories and decided to include the Strategy of European fleets, provided by EUROFLEETS-2 during the OFEG (Ocean Fleet Evolution Group) Meeting in Paris in May 2nd 2016, in their implementation plans.

The survey carried out by the ENVRIPLUS team made it possible to collect the needs in terms of oceanographic vessels for the EMSO, FIXO3 and PIRATA infrastructures. Data are summarized in the table 8.

5.3 SIOS needs

SIOS (Svalbard Integrated Arctic Earth Observing System) is a regional observing system for long-term measurements, which integrates the existing distributed observational infrastructures in and around the Norwegian archipelago of Svalbard (such as Ny Alesund international science village, UNIS and Longyearbyen, Hornsund and Barentsburg, as well as some facilities at the coal mine sites of Svea and Pyramiden) in order to address Earth System Science questions. Svalbard is a key international arena to monitor, study and understand how climate change is affecting the biosphere, cryosphere, atmosphere and hydrosphere.

The objective of the SIOS programme is not to subsume or replace existing access schemes provided by national operators but rather to provide a different set of access opportunities that complement and extend the current opportunities to utilise research infrastructure on Svalbard. Indeed, within SIOS, researchers could cooperate to access instruments, acquire data and address questions that would not be practical or cost effective for a single institution or nation alone.

The following figure gives an overview of the locations of the existing (black, purple, blue and red dots) and new (green stars, red arrows) marine platforms, stations and moorings capable of observing the marine environment around Svalbard in both the vertical and horizontal plane.

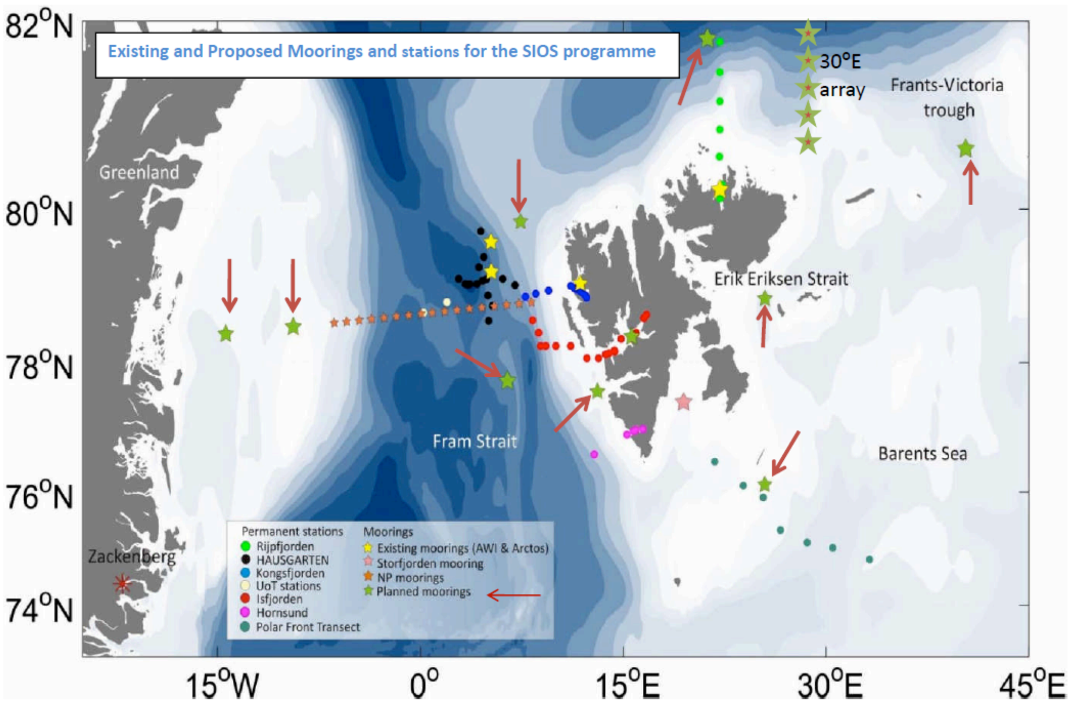

Figure. 8 Existing and proposed mooring and marine stations of the SIOS programme

Even if all these marine platforms, stations and moorings form an efficient Earth System monitoring, a world-leading Arctic monitoring capability could be facilitated by upgrading certain instrumentation and adding new research capabilities and these are identified here. Moreover, it is recognised that more detailed monitoring is needed to really understand both the complex flow of waters around Svalbard where recirculation is common and to monitor ecosystems.

In order to establish the complete core elements of an integrated Earth Observing System, all infrastructures required were listed, detailed and prioritized in the SIOS Preparatory Phase Deliverable D3.4[3]. This table, of which an extract is presented below, details the precise needs of the SIOS RI in terms of location of operation, parameters and prioritization. For some locations, the SIOS program had already identified a potential vessel that could perform the measurements.

Location	Parameters	Platform initially planned by SIOS	Priority (1, 2, 3)
West Svalbard	T/S, currents	RV Oceania	1
Fram Strait	T/S, currents	RV Polarstern	1
Kongsfjord/KongHau	Temp/Salinity	Various ships	2
Across Fram Strait	Tracers (S, d18O, N:P, alkalinity), revealing sources of Arctic Ocean freshwater components	CTD rosette water samples	1
Hausgarten and Kongsfjord transect	Service cruises-pelagic sampling	RV Polarstern?	1
Hornsund, Isfjorden and Rijpfjorden transect	Service cruises (incl. pelagic sampling on Barents Sea Polar front Transect)	RV Oceania?	1
Fram Strait (Deep)	Ocean Acoustic data	Acoustic Artic Laboratory	2
Isfjorden, Bellsund, off shelf west of Bellsund/Smeerenburg, offshelf N of Rijpfjorden, Grønfjorden, Erik Eriksen Strait, Frans-Victoria Trough, N Barents Sea, E. Greenland Shelf	Hydrography, velocity, zooplankton biomass and vertical distribution, sedimentation, Chlorophyll, sea ice thickness	Moorings: CTD, temperature loggers, ADCP, sediment traps, fluorometer	2
Western Svalbard slope	Current profile with CTD/fluorescence	Mooring (ADCP and 2 Microcats)	1
Fram Strait	Mean ocean temperature and currents, acoustic signals for glider navigation	Triangle tomography moorings	2
Fram Strait	Hydrography, velocity, sedimentation, Chlorophyll, oxygen, nutrients	Upgrade of Fram Strait moorings with sediment traps and biological sensors	1

Table. 7 Need of the SIOS Research Infrastructures

Thanks to our method, presented in subsection 3, we are able to propose an alternative to the already identified vessel (in case of withdrawal of the ship) and assist the SIOS program in identifying other possible ships for the other locations not yet assigned with a ship. An example is given, in the table (Table. 8), for 2 stations, the West Svalbard station and the Fram Strait stations.

Application of the method:

Our method does not include the icebreaking capacities of the vessels which may introduce a bias. The two stations are located in the Arctic area. The West Svalbard SIOS station needs ADCP measurements, small CTD deployment and a ship with a minimum size of 30 m. We do not know the number of ship days necessary to realize the operation, neither the frequency of the operation. For the SIOS Fram Strait stations, technical capacities required would be ADCP measurements, CTD rosette deployment, heavy mooring capacities, AUV deployment (glider) and a ship with a minimum size of 45 m. Here too, the number of ship days, neither the frequency of the operation is known. According to our method, the vessels that could operate for the SIOS RI are listed in the table 8.

[3] [Ellis-Evans et al.] Ellis-Evans C., Holmen K., Callaghan T., Cottier F., Dickson R., Drinkwater M., Heimann M., Kroeger S., Andersen B. (2014) SIOS Infrastructure Optimisation Report. D3.4, SIOS Program.

For the SIOS West Svalbard station, 21 ships, in addition to the R/V Oceania which has been already identified by the SIOS programme, could be suitable. However, for the SIOS Fram Strait stations, only 5 ships could be suitable.

5.4 JERICO needs

In the continuity of JERICO (FP7), the objective of JERICO-NEXT consists in strengthening and enlarging a solid and transparent European network in providing operational services for the timely, continuous and sustainable delivery of high quality environmental data and information products related to marine environment in European coastal seas.
JERICO is able to federate the FerryBox activities and provide them requirements.
Other requests for cruises in the coastal zones are not centralized by JERICO.

5.5 ICOS needs

ICOS RI (Integrated Carbon Observation System Research Infrastructure) is a pan-European Research Infrastructure, which objective is to provide the long-term observations required to understand the present state and predict future behavior of the global carbon cycle and greenhouse gas emissions and concentrations.

The Ocean Thematic Centre (OTC) is one of four central facilities within the European ICOS RI. The marine elements of the ICOS RI provide the long-term oceanic observations required to understand the present state and predict future behaviour of the global carbon cycle and climate-relevant gas emissions.

The Marine ICOS observation network cooperates with the International Ocean Carbon Coordination Project (IOCCP) to cover the global ocean observing systems which is based on Voluntary Observing Ships (VOS), Fixed Ocean Stations (FOS), Repeat Ocean Sections (ROS), Marine Flux Towers (MFT).

The figures below show the present network status of the measurements of surface pCO2 around the world and the ICOS OTC stations and cruise tracks respectively.

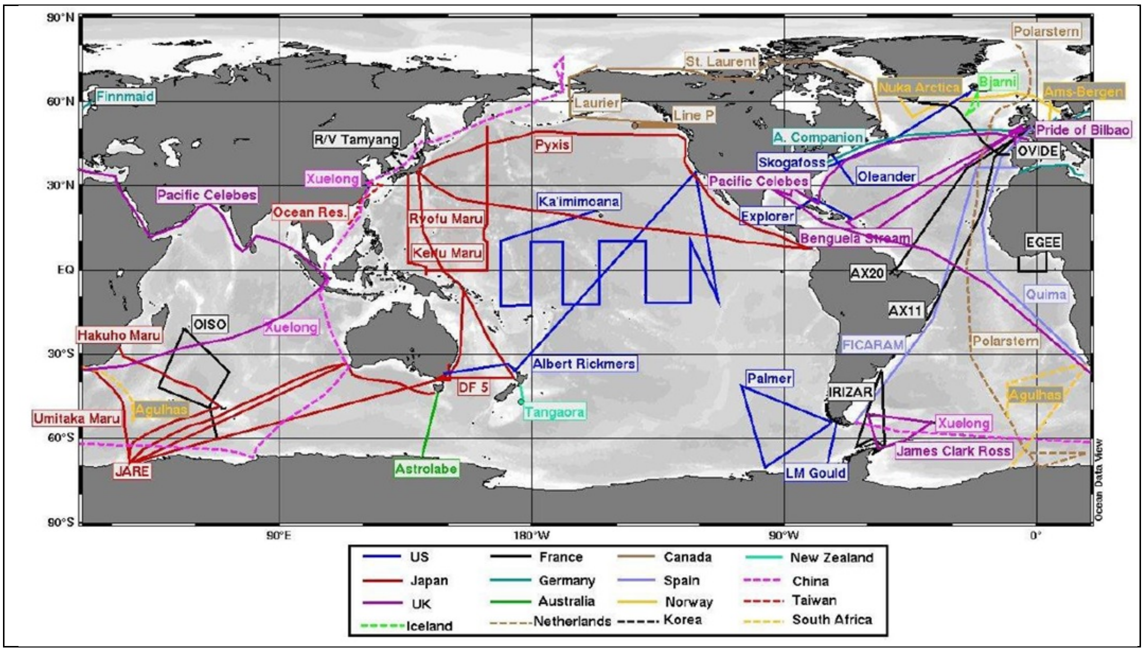

Figure. 9 Actual network status of the measurements of surface pCO2 (IOCCP.org)

Figure. 10 ICOS OTC stations and cruise tracks

Some of ships already collaborate but the area covered is not sufficient. One of the objectives of the IOCCP project and ICOS are to develop the implementation of pCO2 sensors on vessels. However, implementation of pCO2 sensors on geographical desirable platforms is challenging because

- Ships only ply certain routes and routes can change at short notice;
- Obtaining access to the ships is not straight forward. Multiple entities can be involved in a vessel management making it difficult to establish who has the authority over modifications to ship and work with the crew.

The Marine ICOS observation network would like to develop its network by implementing 21 new fixed time series stations, which are presented in the following figure. Some of these fixed stations have been included in the FixO3 network.

1. Hausgarten, Fram Strait – Germany
2. Ocean Weather Station M, 66°N/2°E – Norway
3. Irminger Sea, 64.33°N/28.00°W – Iceland
4. Iceland Sea, 68.00°N/12.67°W – Iceland
5. Östergarnsholm, Baltic Sea – Sweden
6. Utö, Baltic Sea – Finland
7. Marsdiep, North Sea – Nederlands
8. Liverpool Bay, Irish Sea – UK
9. L4, Western English Channel – UK
10. EI, Western English Channel – UK
11. Station Pap, 49°N/16°W – UK
12. MINAS, off Spain, 43°N/11°W – Spain
13. MOOSE, Mediterranean, 43°N/7.9°E – France
14. PALOMA – Italy
15. ODAS – Italy
16. ENEA – Italy
17. GIFT, Gibraltar, 35°N/5°W – Spain
18. ESTOC, Canary Island, 29°10'N/15°30'W – Spain
19. Cap Verde Islands – Germany
20. PIRATA 6°S/10°W tropical Atlantic – France
21. PIRATA 8°S/38°W tropical Atlantic – France

Figure. 11 ICOS proposed fixed time series stations

5.6 EMBRC needs

The European Marine Biological Resource Centre (EMBRC) is a distributed European Research Infrastructure that aims to provide a strategic delivery mechanism for excellent and large-scale marine science in Europe. It set up to become the major RI for marine biological research, covering everything from basic biology, marine model organisms, biomedical applications, biotechnological applications, environmental data, ecology, etc. The main purpose of EMBRC is to promote marine biological science and application of marine experimental models in mainstream research by providing the facilities (lab space), equipment (e.g., electron microscopes, real time PCR machines, crystallography, lab equipment, equipment for accessing the environments such as research vessels, scientific divers, ROVs,etc.), expertise and biological resources that are necessary for carrying out biological research. With its services, EMBRC will support both fundamental and applied research based on marine bioresources and marine ecosystems and will promote the development of blue biotechnology. EMBRC includes a set of coastal laboratories involved in biology oriented oceanographic research.
EMBRC intervenes on several areas, all situated in Europe (Mediterranean Sea, North East Atlantic and North Sea):

- Belgium: Coastal Waters (off Ostend);
- United Kingdom: Coastal waters off Plymouth, Aberdeen, St Andrews, Oban, Antarctica (through British Antarctic Survey);
- France: Coastal waters off Roscoff, Banyuls-sur-Mer, Villefrance-sur-Mer ;
- Spain : Coastal waters off Northern Spain;
- Portugal: Coastal waters off Faro and Porto;
- Italy: Coastal waters off Naples/Bay of Naples;
- Greece: Aegean Sea;
- Israel: Coastal waters off Eilat.

EMBRC stations have usually access to their own small coastal research vessels (Appendix 7 – EMBRC ships), which provide the access required for the majority of work carried out by the research infrastructure. This work is predominantly for sampling purposes for near shore intervention.

EMBRC has access to some larger vessels through its partners, including *Scotia* and *Aegaeo*, again for sampling purposes on request. In addition, remote access to the vessels of the British Antarctic Survey is also possible for providing access to Antarctic samples. These ships seldom have authorisation to navigate away from the shore. On the other hand, EMBRC lab scientists are organizing or participating to ship cruises in coastal, regional or open ocean context.

EMBRC is currently interested to explore areas outside of EMBRC reach, such as abyssal plains, deep-sea trenches or hydrothermal vents (for example the PharmaDeep cruise organized through EUROFLEETS). This kind of cruises would require much larger vessels with suitable capability, probably in the Global and Ocean classes. The choice of the oceanographic vessel will be made according to its capacity to be able to deploy small CTD, CTD Rosette and ROV and also if it is equipped with VSAT transmission to shore. The need is of 1 day participation part of one cruise every two years for each of the EMBRC stations.

5.7 KM3Net requirements

KM3NeT (KiloMetre Cube Neutrino Telescope) is an ESFRI supported infrastructure dedicated to neutrino telescope. The main infrastructure is constituted of mooring lines deployed in calm areas of deep Mediterranean Sea and holding photo detectors in glass spheres able to track the Cherenkoff effect induced by neutrino interaction with matter. The initial three proposed sites are cabled to the shore at:

- KM3Net France (ANTARES and MEUST) is situated in Ligurian sea (Mediterranean Sea) south of Porquerole island in the south of France, at 40 km South of Toulon at 2450 m depth, 42°48. 3N, 6°01. 6E;
- KM3Net Italy (NEMO Catania and Capo Bassero) is situated in East and South Sicily (Mediterranean Sea) about 100 km off the Coast of Sicily at the beginning of the Ionian Abyss. The centre of the Capo Passero Block CPS is at 36°25. 010N, 015°53. 660E at 3470 m depth;
- KM3Net Greece (NESTOR) is situated in West Peloponese (Mediterranean Sea) at 36°50. 012N, 21°30. 003E at 3500 m depth.

Each underwater neutrino telescope is offering extension for Earth and Sea science which are EMSO-ERIC observation sites.

The construction is done step by step starting with the cable laying and the deployment of large electrical and fiber optic junction boxes. This first phase is mobilizing cableships from the MECMA (Mediterranean consortium of large cable laying and repair vessels positioned permanently at Mediterranean harbours for fast intervention at sea).

One possible role for the Oceanographic vessels and oceanographic ROVS is to deploy the neutrino telescope lines, connect them and repair.

The assessment of oceanological conditions (luminescent plankton blooms, acoustic characteristics, optical characteristics) around the neutrino observatory and the associated science experiments of EMSO is also needed either as a yearly EMSO observatory maintenance cruise with ROV dive or as seasonal cruise with a vessel of the regional coastal fleet.

The cruises of KM3Net Greece and France require regional boats (between 30 to 70 m) but higher sizes can still be used. These two cruises needed vessels able to deploy light and heavy moorings, equipped with dynamic positioning and submersible positioning and able to embark 2 container 20’ and underwater vehicle. The objective is to deploy detection lines and then connect them thanks to wet-mateable connectors using a ROV. For the KM3Net France cruise, a deep sea winch of > 2500m is needed (> 3500 m for the KM3Net Greece cruise). Deep sea positioning on this infrastructure is based on the acoustic Long BaseLine ‘’RAMSES’’ system from IxBlue installed on the surface ship as detection lines have to be install on seabed with a precision of about 1m. For this system, a ~5m pole is needed in order to fix the RAMSES transducer at few metres under the sea surface. The installation on board of a Hydrins inertial central is also needed, as well as an interface with the GPS of the ship. The number of operations planned on the KM3Net France site is about 6 to 8 per year from 2018 to 2022 and from 2023, 1 or 2 operations per year with 3 to 4 ship days. The number of operations planned on the KM3Net Greece site is about 2 to 3 per year with 3 to 4 ship days.

The KM3Net Italy cruises need Global or Ocean type vessels (> 60 m), equipped with ADCP, dynamic positioning, submersible positioning and VSAT transmission to shore, able to deploy small CTD and CTD Rosette and underwater vehicle, and able to embark container 20’. To suit the need of the cruise, the vessel comes with one client container (fully equipped with 4 work stations) and with the necessary containers to support the activities (survey, ROV control, ROV spares and general spares). ROV has to be an enhanced work class ROV with a working depth rating up to 4500 m. Back deck: A-Frame with 30t capacity and traction winch system containing 5000 meters (preferable) synthetic rope. An important factor is also the available deck space to store equipment for batch deployments. Requirements are roughly 50 m x 15 m (or 500 m^2 free/fully accessible deck space). The number of operations planned on the KM3Net Italy site is about 2 to 3 per year for the next five years with 5 to 10 ship days.

5.8 Solid Earth requirements

5.8.1 EPOS

The European Plate Observing System (EPOS) is a long-term plan, which aims at creating a pan-European infrastructure for solid Earth science to support a safe and sustainable society. EPOS will enable innovative multidisciplinary research for a better understanding of the Earth’s physical and chemical processes that control earthquakes, volcanic eruptions, ground instability, tsunami, and all those processes driving tectonics and Earth’s surface dynamics. Through the integration of research infrastructures and data, EPOS will allow scientists to make a step change in developing new geo-hazards and geo-resources concepts and Earth science applications to help address key societal challenges.

EPOS brings together 25 European nations and combines national solid Earth science infrastructures and their associated data and models together with the scientific expertise into one integrated delivery system for the solid Earth.
EPOS considers that the underwater networks observing the European Plate are relevant to EMSO.

5.8.2 ECORD

The European Consortium for Ocean Research Drilling (ECORD) is a management structure of 15 members (14 European countries and Canada) for scientific ocean drilling as part of the International Ocean Discovery Program (IODP) “Exploring the Earth under the sea” (and previously the Integrated Ocean Drilling Program from 2003 to 2013). ECORD addresses crucial questions in Earth, Ocean, Environmental and Life sciences based on drill cores, borehole imaging, observatory data, and related geophysical imaging obtained from beneath the ocean floor using specialized ocean-going drilling and research vessels and platforms. As a contributing member of IODP, ECORD is entitled to berths on every IODP expedition.

Three platform providers conduct IODP expeditions: the U.S.A. (National Science Foundation (NSF)) and Japan (JAMSTEC), which operate deep-sea drillships, JOIDES Resolution and Chikyu respectively and ECORD, which is responsible for funding and implementing Mission-Specific-Platform (MSP) expeditions. Whereas the US and Japanese ships are dedicated fitted out with permanent drilling, laboratory and core repository facilities, MSPs are platforms especially chosen to fulfil particular scientific objectives. Platforms used for MSPs are often smaller than US and Japan platforms and require a flexible planning, both by scientists and drilling technicians, due to vessel onboard restrictions.

ECORD Infrastructure may from time to time in future consider using RVs but it is possible that the access to the European fleet would only ever happen when the access is provided as an in-kind contribution by a European partner to the drill leg. Indeed, there has only ever been one example of this when NERC provided access to the James Cook for "free" in support of a rock drilling mission on the mid-Atlantic Ridge around 2 years ago. From the future drill plans of ECORD Infrastructure, it seems unlikely that a RV will be used in the short-medium term (i.e. 1-5 years).

Figure. 12 JOIDES Resolution (National Science Foundation) and Chikyu ships (JAMSTEC)

6 SYNTHESIS OF REQUIREMENTS TOWARDS RESEARCH VESSELS

Oceans are the lifeblood of Earth, they cover more than 70 percent of the planet's surface, are home to 50 percent of its species and represent 90 percent of the living environment. The oceans drive weather, regulating temperature, and ultimately supporting all living organisms. Throughout history, the ocean has been a vital source of sustenance, transport, commerce, growth, and inspiration. And yet they continue to provide surprises as so little is known about them. Indeed, 95 percent of this realm remains unexplored and unseen by human eyes. Thus, deep sea exploration is a challenging endeavour, possibly even more than space exploration.

All the Environmental Research Infrastructures cited above contribute to gain a better understanding of phenomena happening in the broader Earth systems.

It is for this reason, that it is necessary to continue to upgrade instrumentation already implemented, and to add new research capabilities (moorings, stations). However, to achieve this objective, Research Infrastructures need more access to the research vessels. For this, it is necessary to put in place a plan for sustained multi-years planning of oceanographic vessels for the environmental European Research Infrastructures.

6.1 Synthesis of the Research Infrastructure needs

From the reply to the ENVRIPLUS questionnaire, synthesis tables have been produced (see Appendix 6 – List of Research Infrastructures which participated to the ENVRIPLUS questionnaire). The full text of the reply is included in a separate restricted access document[4], which will be open for similar works in the future.

[4] *"Synthesis of questionnaires - Access to the European oceanographic fleets by large research infrastructures".*

Table. 8 Table of synthesis of identified vessels according to required Research Infrastructure parameters

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
EMSO-Azores	Atlantic Ocean	> 60 m	Phys1, Phys3, Phys4, DP, Sub Pst, VSAT, Lab, Deep ROV (Victor 6000)	15-25	Yearly	24	19	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Maria S. Merian Meteor Celtic Explorer Pelagia Discovery James Cook	L'Atalante Pourquoi pas?	With minor modification : James Cook, Discovery, Meteor and Maria S. Merian
EMSO-Azores-Condor	Atlantic Ocean	> 40 m	Phys1, Phys3, Phys4, DP, Sub PST, VSAT, Lab	15	Yearly	24	22	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Maria S. Merian Meteor Celtic Explorer Pelagia Discovery James Cook		
EMSO-Nice	Mediterranean Sea	> 30 m	Phys4, Phys5, C20'	2	Every 3 years	39	31	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas? Thalassa Maria S. Merian Meteor Aegaeo OGS-Explora Pelagia Miguel Oliver Sarmiento de Gamboa James Cook	Mebo, With minor modification : L'Atalante, Pourquoi pas? Thalassa Maria S. Merian Meteor Sarmiento de G. James Cook	Vessel able to embark Penfeld CPT or Mebo

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
EMSO-Molène	North East Atlantic	< 30 m	Phys2, Phys3	2	Every 3 years	42	4	Thalia Arquipelago Mytilus		Possibility to use boats 30-40 m: Antea Sanna Celtic Voyager Garcia del Cid Prince Madog
EMSO-Ligure	Mediterranean Sea	> 30 m	Phys1, Phys2, Phys4, C10', DP, Lab	5 days (15 days large maintenance)	Yearly (3 years large maintenance)	39	31	Beautemps-Beaupré L'Atalante Pourquoi pas? Marion Dufresne Thalassa Maria S. Merian Meteor Minerva Uno Pelagia Sarmiento de Gamboa James Cook	See KM3Net cruises with ROV.	Coastal or local ships are used for the yearly intervention when no heavy work is planned. For instance, Tethys II and Europe.
EMSO-Hellenic	Mediterranean Sea	20-80 m	Phys1, Phys2, Phys3, Phys4, Phys5, Sub PST, Lab, R/A	3-5 days	Every 6 months	39	31	Thalassa Aagaeo Pelagia Sarmiento de Gamboa		Possibility to use boats > 80 m: L'Atalante Pourquoi pas ? Maria S. Merian Meteor Discovery James Cook

Need of the Research Infrastructure						Fleet capacities				
RI	Area of operation Filter 1	Size of the ship Filter 2	Technical capacities Filter 3	Ship days	Frequency	Filter 1*	Filter 2*	Filter 3	Filter 4 Submersible vehicle	Observations
EMSO-Marmara	Marmara Sea	> 30 m	Phys1, Phys2, Phys4, Lab	21	Yearly	39	33	BIOS DVA Antea Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Thalassa Maria S. Merian Meteor Aagaeo Minerva Uno OGS-Explora Pelagia Mare Nigrum Francisco de P. Navarro Garcia del Cid Sarmiento de Gamboa Alendar II Discovery James Cook	If ROV : L'Atalante Pourquoi pas ? Maria S. Merian Meteor Sarmiento de Gamboa Discovery James cook	
EMSO-Galway Bay site	North East Atlantic	< 70 m	Phys2, Phys4, C10' (2), C20' (1), DP, Sub PST, Lab, R/A Optional: Phys1, Phys 3	20 days	12 per year	42	25	Celtic Explorer Sarmiento de Gamboa		Possibility to use boats > 70 m: Maria S. Merian Meteor Sonne L'Atalante Pourquoi pas ? Thalassa James Cook Optional capacities: Phys1, Phys3 Celtic Explorer Sarmiento de Gamboa

Need of the Research Infrastructure						Fleet capacities				
RI	Area of operation Filter 1	Size of the ship Filter 2	Technical capacities Filter 3	Ship days	Frequency	Filter 1*	Filter 2*	Filter 3	Filter 4 Submersible vehicle	Observations
EMSO-Galway-M6 sentinel site	North East Atlantic	> 30 m	Phys2, Phys3, Phys4, Phys5, C10' (4), C20' (2), DP, Sub PST, VSAT, Lab, R/A Optional : Phys1	10 days	2 per year	42	38	Beautemps-Beaupré L'Atalante Pourquoi pas? Thalassa Maria S. Merian Meteor Sonne Celtic Explorer Sarmiento de Gamboa James Cook		Optional: Phys1 Same vessels
EMSO-Portugal-CadizObs	North East Atlantic	60-80 m	Phys1, Phys2, Phys5, C20', DP, R/A	10 days	Yearly	42	14	Thalassa Celtic Explorer Sarmiento de Gamboa Pelagia		Possibility to use boats > 80 m: L'Atalante Pourquoi pas ? Maria S. Merian Meteor Sonne James Cook Optional (< 60 m): Ramón Margalef Angeles Alvariño
EMSO-Portugal-NorthPObs	North East Atlantic	30-70 m	Phys1, Phys2	7 days	Yearly	42	19	Belgica Antea Heincke Sanna Celtic Explorer Celtic Voyager Pelagia Almirante Gago Coutinho Dom Carlos I Angeles Alvariño Garcia del Cid Ramón Margalef Vizconde de Eza Corystes Prince Madog		Possibility to use boats > 80 m: Beautemps-Beaupré L'Atalante Marion Dufresne Thalassa Pourquoi pas ? Maria S. Merian Meteor Polarstern Sonne Hesperides Discovery James Clark Ross James Cook

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
PLOCAN	Atlantic Ocean	> 60 m	Phys 3, Phys 5, DP, Lab Optional (Phys 1, C10', C20', VSAT, R/A)	5 days	2 to 4 per year	24	19	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Maria S. Merian Meteor Celtic Explorer G.O. Sars Pelagia Discovery James Cook		With optional capacities : L'Atalante Pourquoi pas? Maria S. Merian Meteor Celtic Explorer G.O. Sars Pelagia James Cook Optional (< 60 m): Vizconde de Eza
PIRATA RI Cruises	Tropical Atlantic	10 science berths; > 60 m	Phys 1, Phys 3, Phys 5, Lab	≈ 70 days	Yearly	24	19	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas? Maria S Merian Meteor Polarstern OGS-Explora Celtic Explorer GO Sars Pelagia Discovery James Cook		Thalassa has been occasionally used by the French fleet infrastructure as substitute, then extending its area to Atlantic Ocean.
SIOS - Fram Strait	Arctic Ocean	> 45 m	Phys1 Phys3 Phys5 R/A	?	?	36	30	Magnus Heinason Aranda L'Atalante Pourquoi pas ? Thalassa Celtic Explorer GO Sars Maria S. Merian Meteor Polarstern Sonne Pelagia Discovery		RV Polarstern is a vessel already selected to realize these cruises Icebreaking characteristics are not addressed, nor used as a filter in the method.

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
SIOS – West Svalbard	Arctic Ocean	> 30 m	Phys1 Phys2	?	?	36	35	Dana Magnus Heinason Aranda L'Atalante Pourquoi pas ? Thalassa Elisabeth Mann Borgese Heincke Maria S. Merian Meteor Polarstern Sonne Sanna Paamiut OGS-Explora Celtic Explorer G.O. Sars Kristine Bonnevie Helmer Hanssen Johan Rudd Konpriss Haakon Pelagia Oceania Discovery, James Clark Ross James Cook		RV Oceania is a vessel already selected to realize these cruises.

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
EMBRC	Mediterranean Sea	All ships	Phys 2, Phys 3, VSAT, R/A	1 day	1 time every 2 years	39	39	Vessels > 60 m L'Atalante Pourquoi pas? Thalassa Maria S. Merian Meteor Aegaeo Pelagia Angeles Alvariño Sarmiento de Gamboa Discovery James Cook Vessels < 60 m L'Europe Minerva Uno Mare Nigrum		Boats used by EMBRC: Vettoria (19 m) Ippocampo (7.5 m) Phoenicia (10 m) RUFI II (7.5 m) Sagita II (12 m) Velelle (7 m) Pelagia (6m) Minerva Uno Sam Riothberg (16 m) Aegaeo Philia (26.1 m) Alkyon (13.4 m) Luigi Sanzo (15 m) Bio 4U (7.5 m) Balistes (5.95 m) Pagrus (8.3 m)
EMBRC	North Sea	All ships	Phys 2, Phys 3, VSAT, R/A	1 day	1 time every 2 years	45	45	Vessels > 60 m L'Atalante Pourquoi pas? Thalassa Maria S. Merian Meteor Polastern Sonne Celtic Explorer G.O. Sars Pelagia Discovery Endeavour, James Cook Vessels < 60 m Belgica Simon Stevin Celtic Voyager Oceania Prince Madog		Boats used by EMBRC: Rigid zodiac Simon Stevin MBA Sepia (15.4 m) NEREIS II (15 m) Aurelia Zoé Litus (12 m) Dallaporta Swordsman (7.5 m)

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
EMBRC	North East Atlantic	All ships	Phys 2, Phys 3, VSAT, R/A	1 day	1 time every 2 years	42	42	Vessels < 60 m Belgica Celtic Voyager Angeles Alvariño Ramón Margalef Prince Madog Vessels > 60 m L'Atalante Pourquoi pas? Thalassa Maria S. Merian Meteor Polarstern Sonne Celtic Explorer Pelagia Sarmiento de Gamboa James Cook Discovery Endeavour		Boats used by EMBRC: Rigid zodiac Pelagia (5.5 m) Fulespid (5.5 m) Kraken (7.5 m) Calanus (20 m) Seol Mara (12 m) Belgica
KM3Net Greece	Mediterranean Sea	> 30 m	Phys 4, Phys 5, C20' (2), DP, SubPst, R/A, ROV (3000 m)	3-4 days	2-3 campains per year	39	33	L'Atalante Pourquoi pas ? Thalassa Maria S. Merian Meteor Pelagia Sarmiento de Gamboa James Cook	L'Atalante Pourquoi pas ? Thalassa Maria S. Merian Meteor Sarmiento de Gamboa James Cook	
KM3Net France	Mediterranean Sea	> 30 m	Phys 5, C20' (2), DP, Sub Pst, R/A, ROV (2000 m)	3-4 days	6-8 operations per year	39	33	L'Atalante Pourquoi pas ? Thalassa Maria S. Merian Meteor Pelagia Sarmiento de Gamboa Angeles Alvariño James Cook	L'Atalante Pourquoi pas ? Thalassa Maria S. Merian Meteor Sarmiento de Gamboa James Cook	

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
KM3Net Italy	Mediterranean Sea	> 60 m	Phys 1, Phys 2, Phys 3, C20', DP, Sub Pst, VSAT, R/A, ROV (4500 m)	5-10 days	2-3 operations per year	39	17	L'Atalante Pourquoi pas? Thalassa Maria S. Merian Meteor Pelagia Angeles Alvariño Sarmiento de Gamboa James Cook	L'Atalante Pourquoi pas? Thalassa Maria S. Merian Meteor Sarmiento de Gamboa James Cook	
FixO3 PAP	North East Atlantic	> 60 m	Phys 1, Phys 3, Phys 4, Phys 5, C20', DP, VSAT, Lab	10 days	Yearly	42	26	Beautemps-Beaupré L'Atalante Marion Dufresne Pourquoi pas? Thalassa Maria S. Merian Meteor Sonne Celtic Explorer Pelagia Sarmiento de Gamboa James Cook		For instance, RV Meteor was used for a FIXO3 PAP Cruise in 2014.
FixO3 Station M	Arctic Ocean	> 30 m	Phys 3, Phys 5, DP, VSAT, Lab (2)	1 day	Twice a year	36	35	Aranda L'Atalante Thalassa Pourquoi pas ? Maria S. Merian Meteor Sonne Celtic Explorer G.O. Sars Pelagia Discovery James Cook		

Need of the Research Infrastructure						Fleet capacities				
RI	**Area of operation Filter 1**	**Size of the ship Filter 2**	**Technical capacities Filter 3**	**Ship days**	**Frequency**	**Filter 1***	**Filter 2***	**Filter 3**	**Filter 4 Submersible vehicle**	**Observations**
FixO3 Biscay AGL Gulf of Gascogne	North East Atlantic	30-70 m	Phys1, Phys 3, Phys 5, C20', DP, Lab	2-3 days for mooring and 1 day for validation	Every 4 months for mooring and every month for validation	42	19	Celtic Explorer Pelagia Angeles Alvariño Ramón Margalef Sarmiento de Gamboa		Optional (> 70 m): Beautemps Beaupré L'Atalante Marion Dufresne Pourquoi pas ? Thalassa Maria S. Merian Meteor Sonne James Cook

** Number of possible ships*

6.2 Limit of the study

The brand new EUROFLEETS database has been crucial to allow the here-above study. Such data was not available before. On the contrary, the input from EMSO PP on submersibles has not been updated.
The description of the technical capacities needed by the RIs was only gathered at the end of the study. We have now a more global view. It appears that some of the description of the technical characteristics of the vessels could be more precise and fit better with the requests. Common vocabulary and term of reference could be agreed on before a similar exercise is launched again.
It sometimes leads to allocate some vessels for some RI request which seem unusual. **We apologize if this is not realistic as we had no time to check the results with all ship operators.**
We were not able to check either if some vessels have not been rejected for a mission due to a very minor difference in technical criteria.
The ice breaking capacities (several classes according to Classification Societies) have not been addressed.
The geographic positioning of the sites has not been exploited completely. It would require a discussion with the ship operators to refine the definition of their area of operation at a precise year.
The RI landscape of marine fixed point observatories is changing with the end of FixO3 and the launching of EMSO ERIC. EMSO ERIC will mostly include the FixO3 sites but the status of the ICOS marine fixed sites is not yet clear. For this reason, we collected data from most sites but not all.

7 SCENARII OF COMMON PLANNING

The ENVIRONMENT RESEARCH INFRASTRUCTURES (and some RIs operating similar equipment such as KM3Net) are used to articulate their policies with the satellite infrastructures, the modelling communities and the e-infrastructures. This is relevant in a data access point of view but needs to be completed by Physical access to large infrastructures such as ships and especially the Research Vessels.
Provided its limitations (see §6.2), the present exercise of cross comparison of RI needs and Research Vessels potential shows the way to regular relations. They could lead to common planning of expected physical access:

- On a multi-year basis providing non-binding estimates of ship time amount. The use would be to inform the funding bodies, such as national agencies and EU, and the RI governance instances of the amount of cross activities;
- On a bartering principle and without addressing the real costs;
- Initiate the discussions on the adaptation of RI instruments, of ships or of ship gears and on interoperability perspectives;

The yearly Research Vessel planning would then lead to bilateral RI-ship operator discussions and agreements.

The suggestion of a permanent “European Fleets Coordination System of European Research Fleets” suggested by EUROFLEETS2 (see§2.3) is relevant for a coordination of the process. ERVO will play a major role. We suggest to include a research vessel planning potential role for ENVRI community in the ENVRI legacy plan.

8 NEXT STEPS

8.1 Role of EUROFLEETS

A topic « Research Vessels » is included in the EC’s work program 2018-2020. The EUROFLEETS2

projects ends in June 2017. In perspective of the preparation of the 3rd proposal, a "Research Vessels" topic has been included in the H2020 2018-2020 Work Programme. Oceanographic vessels are recognized as Advanced Communities and the European Commission does not pretend to constrain national choices but to promote access, ensure optimal use and joint development.
One could expect a follow up of this study and elaboration of mid term plans.

8.2 Role of ENVRIPLUS

The introduction of the H2020-INFRAIA-2018-2020 call shows a good understanding by the European Commission of the complexity of the Research Infrastructure landscape. Research Vessels are understood as "Advanced Communities" in the same way as Research aircrafts or climate Earth system modeling. Their needs are different in term of "efficient and coordinated operation" because their physical access procedure are well established at national level but need integration and improvement.
This introduction opens the way to ENVRI community implication: "*ESFRI* (**in our environment field it means ENVRI community**) *and other world-class research infrastructures (***in the context of this deliverable we think of JCOMMOPS***) are not specifically targeted by this call. Nevertheless, where relevant, they can participate in an integrating activity together with other national and regional research infrastructures.*
We hope the exercise of the present deliverable[5] could open the way to such an integrating activity between national fleets and Environment RIs. A regular (yearly?) exercise of matching needs and capacities is feasible, not very time consuming and will benefit to all type of infrastructures (ERIC or not, advanced or recently initiated, national or backed by world scale consortia,…).

8.3 Role of JCOMMOPS

In addition to the planning of research vessels, JCOMMOPS is able to find solutions for the requests of several RIs for exceptional or regular access to ocean sites.

8.4 Role of individual RIs

SIOS

The estimated need for research vessels for SIOS used in this report is based on the assessment made during the SIOS preparatory phase. As SIOS moves in the operational phase we need to reassess both the need for and the availability of research vessels. SIOS is planning a pilot access programme in 2018 and ship time is currently not included in this pilot due to insufficient time for planning. We plan to include research vessels in future calls, which will require consideration of availability of vessels and the needs of research projects. The assessment made in this report will be useful in planning our future options in relation to access to research vessels. Due to operating in the Arctic, the ice breaking capability of research vessels could be an important consideration that needs to be reviewed for future operations.

EMSO ERIC

The strategy of EMSO ERIC includes the logistic service which will be provided to EMSO sites to help finding Research Vessels opportunities. In the EMSOLink H2020 project, the update of the review of the Research vessels able to operate ROVs (Table 4 in this document) is planned in 2018.

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5 In addition to the D11.2, Full replies to the questionnaire are included in a separate document which is made available to the ENVRIPLUS project and uploaded on the Activ Collab project site.

8.5 Role of ERVO

In any case, ERVO showed its capacity to anticipate on the availability of research vessels and open brokering opportunities. ERVO group has been very positive along this ENVRIPLUS study.

9 GLOSSARY AND TERMINOLOGY

Here is the list of acronyms in alphabetical order.

Acronym	Definition
ACTRIS	Aerosols, Clouds, and Trace gases Research InfraStructure network, http://www.actris.net/
ADCP	Acoustic Doppler Current Profilers
ANTARES	Astronomy with a Neutrino Telescope and Abyss environmental RESearch, http://antares.in2p3.fr/
ARCTOS	Arctic Marine Ecosystem Research Network, https://arctos.uit.no/home
ARGO	Array for Real-time Geostrophic Oceanography, http://www.argo.net/
ASAP	Automated Shipboard Aerological Programme, http://www.jcommops.org/sot/asap/
ATLANTOS	Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems, https://www.atlantos-h2020.eu/
AUV	Autonomous underwater vehicle
BMBF	German Federal Ministry of Education and Research, https://www.bmbf.de/en/index.html
CC	Coastal Class
CMEMS	Copernicus Marine Environment Monitoring Service
COOP Plus	Cooperation of Research Infrastructures to address global challenges in the environmental field, http://www.coop-plus.eu/
CSIC	Consejo Superior de Investigaciones Científicas, http://www.csic.es/
CTD	Conductivity Temperature Depth
DBCP	Data Buoy Cooperation Panel, http://www.jcommops.org/dbcp/
DCF	Data Collection Framework, https://datacollection.jrc.ec.europa.eu/
DCSMM	Directive Cadre Stratégie pour le Milieu Marin
EC	European Commission
ECORD	European Consortium for Ocean Research Drilling http://www.ecord.org/
EMBRC	European Marine Biological Resource Centre, http://www.embrc.eu/
EMODnet	The European Marine Observation and Data Network, http://www.emodnet.eu/

EMSO	European Multidisciplinary Seafloor and Water Column Observatory, http://www.emso-eu.org/
EMSODEV	European Multidisciplinary Seafloor and water-column Observatory DEVelopment, http://www.emsodev.eu/
EOOS	European Ocean Observing System, http://eurogoos.eu/eoos/
EPOS	The European Plate Observing System, https://www.epos-ip.org/
ERA	European Research Area
ERIC	European Research Infrastructure Consortium
ERVO	European Research Vessel Operators, http://www.ervo-group.eu/np4/home
ESF	European Science Foundation, http://www.esf.org/
ESFRI	European Strategy Forum on Research Infrastructures
ESONET	European Seafloor Observatory NETwork, http://www.esonet-noe.org/
EU	European Union
FixO3	Fix point open ocean observatories, http://www.fixo3.eu/
FOS	Fixed Ocean Stations
FP	Framework Programme
GC	Global Class
GCOS	General Comprehensive Operating System
GOOS	Global Ocean Observing System
GOSUD	Global Ocean Surface Underway Data http://www.gosud.org/
GTS	Global Telecommunication System
ICDP	International Continental Scientific Drilling Program, http://www.icdp-online.org/home/
ICOS	Integrated Carbon Observation System, https://www.icos-ri.eu/
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer, http://wwz.ifremer.fr/
IMR-UoB	Institute of Marine Research University of Bergen, http://www.uib.no/en/research/74317/institute-marine-research
INDIGO	Innovation-driven Initiative for the Development and Integration of Indian and European Research, https://indigoprojects.eu/

INFRA	Innovative and Novel First Responders Applications
INMARTECH	International Marine Technician's Workshop
IODE	International Oceanographic Data and Information Exchange http://www.iode.org/
IODP	Integrated Ocean Drilling Program, http://www.iodp.org/
ISOM	International Ship Operators Meeting, http://www.irso.info/
IOC	Intergovernmental Oceanographic Commission, http://ioc-unesco.org/
IOCCP	International Ocean Carbon Coordination Project, http://www.ioccp.org/
IRSO	International Research Ship Operators, http://www.irso.info/
JAMSTEC	Japan Agency for Marine-earth Science and TEChnology http://www.jamstec.go.jp/e/
JCOMM	Join technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	JCOMM in situ Observing Platform Support center, http://www.jcommops.org/board
JERICO	Towards a Joint European Research Infrastructure network for Coastal Observatories, http://www.jerico-ri.eu/
JRA	Joint Research Activity
KM3NeT	KiloMetre Cube Neutrino Telescope, https://www.km3net.org/
LADCP	Lowered Acoustic Doppler Current Profiler
MARsite	New Directions in Seismic Hazard assessment through Focused Earth Observation in the Marmara Supersite, http://marsite.eu/
MECMA	MEditerranean Cable Maintenance Agreement
MEUST	Mediterranean Eurocentre for Underwater Sciences and Technologies, http://meust.cnrs.fr/plaquette_meust_FR.pdf
MFT	Marine Flux Towers
MMP	McLane Moored Profiler
NA	Networking Activity
NOAA	National Oceanic and Atmospheric Administration, http://www.noaa.gov/
NERC	Natural Environment Research Council, http://www.nerc.ac.uk/
NESTOR	Neutrino Extended Submarine Telescope with Oceanographic Research Project, http://www.inp.demokritos.gr/nestor/

NEXOS	Next generation Low-Cost Multifunctional Web Enabled Ocean Sensor Systems Empowering Marine, Maritime and Fisheries Management, http://www.nexosproject.eu/
NIOZ	Royal Netherlands Institute for Sea Research, https://www.nioz.nl/en
NSF	National Science Foundation https://www.nsf.gov/
OC	Ocean Class
OFEG	Ocean Facilities Exchange Group, http://www.ofeg.org/
OFWG	Ocean Research Fleets Working Group
OHI	International Hydrographic Organisation, https://www.iho.int/srv1/index.php?lang=fr
OTC	Ocean Thematic Center, https://otc.icos-cp.eu/
RC	Regional class
RI	Research Infrastructure
RIB	Rigid Inflatable Boat
ROS	Repeat Ocean Sections
ROOS	Regional Operational Oceanographic Systems, http://eurogoos.eu/regional-operational-oceanographic-systems/
ROV	Remote Operated underwater Vehicle
RV	Research Vessel
SeaDataNet	Pan-European infrastructure for ocean & marine data management, http://www.seadatanet.org/
SIOS	Svalbard Integrated Arctic Earth Observing System, https://www.sios-svalbard.org/
SOOP	Ship Of Opportunity Programme, http://www.jcommops.org/sot/soop/
TNA	Trans National Access
T/S	Temperature/Salinity
TSG	ThermoSalinoGraph
UNOLS	University-National Oceanographic Laboratory System, https://www.unols.org/
UK	United Kingdom
US	United States

VOS	Voluntary Observing Ship
WMO	World Meteorological Organization, http://www.wmo.int/pages/index_fr.html
WSC	West Spitsbergen Current
XBT	Expendable bathythermograph

10 APPENDICES

The EUROFLEETS2 survey described in appendices 1 to 3 has been implemented in the frame of the EUROFLEETS2 Work Package 4 “Initiatives towards integrated and cost-efficient operational activities”, Task 4.1 “Regional virtual fleets”, Deliverable 4.2 “Reporting and evaluation of initiatives with pioneering groups”.

10.1 Appendix 1 – Preliminary definitions to use the EUROFLEETS2 database

1) Description of the six classes of vessels

Global Class (G): with their extensive deck space, equipment, and a broad and diverse complement of laboratory space and outfitting, they are equipped to handle a wide array of instruments and to deploy suites of moorings, autonomous vehicles, large and complex sampling tools, and sophisticated acoustical equipment. Some vessels in this class support specialized services, including the operation of deep-submergence vehicles or multichannel seismic reflection equipment. Some are ice- strengthened for operations in higher latitudes.

Ocean Class (O): designed to support integrated, interdisciplinary research and survey missions over one ocean with many of the same capabilities of the modern global class vessels.

Regional Class (R): these vessels operate on the continental shelf and in the open ocean of minimum one geographic area. Regional class vessels are designed to optimize unique regional conditions, such as the capability to work in shallower areas like estuaries and bays, or under seasonally harsh weather conditions.

Coastal Class (C/R and C): these vessels serve a crucial role in supporting science throughout coastal zone where human impacts of development and resource use are greatest. The science missions are largely driven by local and regional needs. Those vessels can stay at sea by night and operate campaigns for more than one day without coming back to harbour. Coastal vessels have been divided in two sub-categories:

- **C/R**: coastal vessels which are managed in a manner than they can realize coastal campaigns everywhere in the area. They are not equipped, like regional vessels do, to operate scientific campaigns in the open ocean of the area
- **C**: coastal vessels which field of operation is limited to a part of the area (typically maximum 200 nm, e.g. Bay of Biscay or Ligurian sea)

Local: Vessels operated on a daily basis.

2) Characteristics of the six vessel classes

Ship class	Global (G)	Ocean (O)	Regional (R)	Coastal (CR and C)	Local (L)
Areas of operation	Minimum 2 oceans	One ocean	Minimum one area	-	-
Range of operation from principal harbor base	-	-	-	> 50 nm	< 50 nm
Length (m)	> 80 m	80 m ≥ L ≥ 60 m	70 m ≥ L ≥ 30 m	45 m ≥ L ≥ 20 m	40 m ≥ L ≥ 15 m
Science berths (including scientists and non permanent technicians	> 25	> 20	> 10	> 5	< 5

3) Different geographic areas of operation

Oceans to which the EUROFLEETS2 database refers to are:

- Arctic Ocean,
- Southern Ocean,
- Indian Ocean,

- Pacific Ocean,
- Atlantic Ocean (including North Sea, Baltic Sea and Mediterranean Sea)

In Europe, 4 maritime areas have been considered in reference to OHI (International Hydrographic Organisation) geographical limits (except for North West Atlantic which is an invention):

- Mediterranean Sea (including Black Sea, Sea of Ozov and Marmara Sea),
- Skagerrak, North Sea and Channel,
- Baltic Sea,
- North East Atlantic.

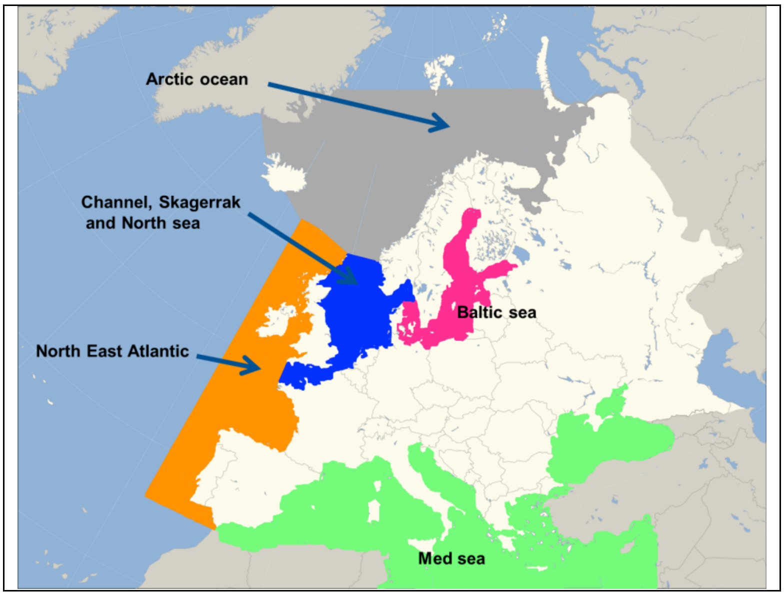


Figure. 13Geographic areas of operation considered in the EUROFLEETS2 database

4) Technical capacities proposed on ship board

Technical capacities need on board	Class
ADCP	Phys 1
Small CTD deployment	Phys 2
CTD Rosette deployment	Phys 3
Light mooring capacity (< 1000 m)	Phys 4
Heavy mooring capacity (> 1000 m)	Phys 5
Container 10’ (number)	C 10’
Container 20’ (number)	C 20’
Dynamic positioning	DP
Submersible positioning	Sub Pst
VSAT transmission to shore	VSAT
Laboratory (number)	Lab
Underwater Vehicles ROV or AUV capabilities or submersibles	R/A

10.2 Appendix 2 - Inventory of European Research Vessels, with their geographical areas of operation (source: EUROFLEETS2 project)

Eurofleets

Country	Vessel	Timeline (1960–2030)	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technician	Area 1 : Artic Ocean incl. Norwegian Sea	Area 2 : Channel skagerrak and North Sea	Area 3 : North East Atlantic	Area 4 : Baltic Sea	Area 5 : Med sea (including Black Sea)	Atlantic ocean except european areas	Pacific ocean	Indian ocean	Southern ocean
BELGIUM	Belgica	Belgica 2020	1984	33	R	RBINS	50,9	12 - 16		1	1						
	Simon Stevin	Simon Stevin	2012	5	C	VLIZ	36	10		1							
BULGARIA	Akademik	Akademik	1979	38	R	IO-BAS	55,5	22					1				
CROATIA	Bios Dva	Bios DVA	2009	8	C	IOF	36,6	18					1				
	Palagruza	Palagruza	1975	42	R	HIRC	45,5	40					1				
	Hidra	Hidra	1994	23	C	HIRC	22,1	6					1				
DENMARK	Aurora	Aurora	2014	3	C	Aarhus Univ.	28	14		1		1					
	Dana	Dana	1981	36	O	DTU aqua	78,43	10	1	1	1	1					
ESTONIA	Salme	Salme	1974	43	CR	TUT	31,3	12				1					
FAROE ISLANDS	Magnus Heinason	Magnus Heinason 2019 New Magnus Heinason	1978	39	R	FAMRI	44,5		1								
FINLAND	Aranda	Aranda	1989	28	O	SYKE	59,2	27	1			1					
France	Alis	Alis	1987	30	CR	IRD	28,4	6							1		
	Antéa	Antea	1995	22	R	IRD	34,95	10		1	1		1	1		1	
	Beautemps-Beaupré	Beautemps-Beaupré	2002	15	O	French Navy	80,64	25		1	1		1	1		1	
	Côtes de la Manche	Côtes de la Manche	1997	20	C	CNRS	24,9	8		1	1						
	L'Astrolabe	L'Astrolabe 2018 New L'Astrolabe	1986	31	O	IPEV	65	50									1
	L'Atalante	L'Atalante	1990	27	G	Ifremer	84,6	29	1	1	1		1	1	1	1	1
	L'Europe	L'Europe	1993	24	R	Ifremer	29,6	8					1				
	Marion Dufresne	Marion Dufresne	1995	22	G	IPEV	120,5	110		1	1		1	1	1	1	1
	Pourquoi pas?	Pourquoi pas?	2005	12	G	Ifremer	107,7	40	1	1	1		1	1		1	
	Thalassa	Thalassa	1996	21	O	Ifremer	74,5	25	1	1	1		1				
	Thalia	Thalia	1978	39	C	Ifremer	24,5	6		1	1						
	Thetys II	Thetys II	1993	24	CR	CNRS	24,9	10					1				
GERMANY	Alkor	Alkor	1990	27	R	GEOMAR	54,59	12	1	1		1					
	Elisabeth Mann Borgese	Elisabeth Mann Borgese	1987	30	R	IOW	56,5		1	1		1					
	Heincke	Heincke	1990	27	R	AWI	54,59	12	1	1	1	1					
	Littorina	Littorina	1975	42	C	GEOMAR	29,82	6		1		1					
	Ludwig Prandtl	Ludwig Prandtl	1983	34	C	HZG	32,5	10		1		1					
	Maria S. Merian	Maria S. Merian	2006	11	G	LDF	94,8	22	1	1	1	1	1	1			
	Meteor	Meteor	1986	31	G	LDF	97,5	30	1	1	1	1	1	1			

Eurofleets

		1960 1970 1980 1990 2000 2010 2020 2030	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technician	European regional areas					Other oceans			
									Area 1 : Artic Ocean incl. Norwegian Sea	Area 2 : Channel skagerrak and North Sea	Area 3 : North East Atlantic	Area 4 : Baltic Sea	Area 5 : Med sea (including Black Sea)	Atlantic ocean except european areas	Pacific ocean	Indian ocean	Southern ocean
	Polarstern	*Polarstern*	1982	35	G	AWI	118	55	1	1	1	1		1			1
	Poseidon	*Poseidon*	1976	41	O	GEOMAR	60,7	11	1	1	1	1	1	1			
	Solea	*Solea*	2004	13	CR	TI	42,4	7	1	1		1					
	Sonne	*Sonne*	2014	3	G	LDF	97,94	25	1	1	1	1			1	1	
	Walther Herwig III	*Walther Herwig III*	1993	24	R	TI	64,5	12	1	1		1					
GREECE	*Aegaeo*	*Aegaeo*	1985	32	R	HCMR	61,5	21					1			1	
	Philia	*Philia*	1986	31	C	HCMR	26,1	6					1				
GREENLAND	*Paamiut*	*Paamiut*	1971	46	R	NATUR	58,6	12	1								
	Sanna	*Sanna*	2012	5	R	NATUR	32,35	10	1		1						
ICELAND	*Arni Fridriksson*	*Arni Fridriksson*	2000	17	R	MRI	69,9	16	1		1						
	Bjarni Saemundsson	*Bjarni Saemundsson*	1970	47	R	MRI	56	13	1								
ITALY	*Andrea*	*Andrea*	1999	18	C	Bologna Univ.	29,2	8					1				
	G. Dallaporta	*Dallaporta*	2001	16	CR	CNR	35,7	12					1				
	Italica	*Italica* 2017	1981	36	G	PNRA	130	92									1
	Minerva Uno	*Minerva Uno*	2002	15	R	CNR	46,6	13					1				
	OGS-Explora	*OGS-Explora*	1973	44	O	OGS	72,63	24	1	1	1	1	1	1	1	1	1
IRELAND	*Celtic Explorer*	*Celtic Explorer*	2002	15	O	MI	65,5	19-21	1	1	1	1		1			
	Celtic Voyager	*Celtic Voyager* 2019 replacement	2002	15	R	MI	31,4	8		1	1						
LITHUANIA	*Mintis*	*Mintis*	2014	3	CR	Klaipeda Univ.	39	12				1					
NORWAY	*Dr. Fridtjof Nansen*	*Dr. Fridtjof Nansen 2017 New Fridjof Nansen*	1993	24	O	IMR	56,8	20						1		1	
	G.M. Dannevig	*G.M. Dannevig*	1979	38	C	IMR	27,85	12	1	1							
	G.O.Sars	*G.O.Sars*	2003	14	O	IMR	77,5	30	1	1				1			1
	Gunnerus	*Gunnerus*	2006	11	C	NTNU	31,25	20	1								
	Hakon Mosby	*Haakon Mosby* 2016 *Kristine Bonnevie (Dr. Fridtjof*	1980	37	R	IMR	47,24	16	1	1							
	Helmer Hanssen	*Helmer Hanssen*	1992	25	O	NCFS-UT	63,8	29	1								
	Johan Rudd	*Johan Rudd*	1976	41	CR	NCFS-UT	30,5	11	1								
	Johan Hjort	*Johan Hjort*	1990	27	O	IMR	64,4	22	1	1							
	Lance	*Lance* 2016 *Konprins Haakon*	1978	39	O	NPI	60,8	25	1					1			1
NETHERLANDS	*Navicula*	*Navicula*	1981	36	C	NIOZ	24	8		1							
	Pelagia	*Pelagia*	1990	27	G	NIOZ	66	15	1	1	1		1	1		1	
	Tridens	*Tridens*	1990	27	R	R-GSC	73,54	13		1							

plus ENVRI

Country	Vessel	1960 1970 1980 1990 2000 2010 2020 2030	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technician	European regional areas: Area 1 : Artic Ocean incl. Norwegian Sea	Area 2 : Channel skagerrak and North Sea	Area 3 : North East Atlantic	Area 4 : Baltic Sea	Area 5 : Med sea (including Black Sea)	Other oceans: Atlantic ocean except european areas	Pacific ocean	Indian ocean	Southern ocean
POLAND	Baltica		1993	24	CR	NFMRI	41	11				1					
	Imoros 1		1967	50	C	Maritime Institute in	20,7	8				1					
	Imor		2006	11	CR	Maritime Institute in	32,5	16		1		1					
	Oceania	Replacement by 2027	1985	32	R	IO-PAS	48,9	14	1	1		1					
PORTUGAL	Almirante Gago Coutinho		1985	32	R	IH	68,2	15			1			1			
	Arquipelago		1993	24	C	IMAR/DOP-UAC	25	6			1			1			
	Dom Carlos I		1989	28	R	IH	68,7	15			1			1			
	Noruega		1978	39	R	IPIMAR	47,5	12			1			1			
ROMANIA	Mare Nigrum		1971	46	R	GeoEcoMar	82	25					1				
SPAIN	Ángeles Alvariño		2012	5	R	IEO	46,7	13			1		1				
	Francisco de P. Navarro		1987	30	C	IEO	30,5	7					1				
	Garcia del Cid		1977	40	CR	CSIC	37,2	12			1		1				
	Hesperides		1991	26	G	CSIC	82,5	37			1			1			1
	Miguel Oliver		2007	10	O	SGPM	70	24			1		1				
	Mytilus		1996	21	C	CSIC	24	10			1						
	Ramón Margalef		2011	6	R	IEO	46,7	11			1						
	Sarmiento de Gamboa		2007	10	O	CSIC	70,5	25			1		1				
	Vizconde de Eza		2000	17	R	SGPM	53	16			1			1			
SWEDEN	Fyrbyggaren		1976	41	R	Stockholm Univ.	42					1					
	Electra		2016	1	C	Stockholm Univ.	24,3					1					
	KBV181		1991	26	C	Umea Univ.	56	8				1					
	Oden		1988	29	G	SPRS	107,8	50	1	1		1					
	Skagerak	Replaced by New Skagerak in 2017	1968	49	R	Göteborg Univ.	38,7	16		1		1					
	Ocean Surveyor		1984	33	R	Swedish Geologica	37					1					
TURKEY	Alemdar II	Refit in 2012	1966	51	R	Istanbul University	63,4	24					1				
	Bilim 2		1983	34	R	IMS	40,36	14					1				
	Koca Piri Reis		1978	39	R	IMST-DEU	36	12					1				
	Tubitak Marmara		2013	4	R	MAM/EMSI	41,2	11					1				
	Surat Arastirma I		1984	33	C	Central Fisheries Re	28,4	10					1				
	Karadeniz Arastirma		2016	1	C	FFAS/RTEU	25	12					1				
	Seydi Ali Reis		2012	5	C	FFAS/SU	22,2	5					1				
	KTU Denar I	Refit in 2014 (Denar I until 1989)	1989	28	C	IMS/KTU	32,47	11					1				
	Yunus S		1994	23	C	IMS/IU	32	12					1				
UNITED KINGDOM	Corystes		1988	29	R	AFBINI	52,5	11		1	1						
	Discovery		2013	4	G	NERC	99,7	28	1	1	1		1	1	1		
	Endeavour		2003	14	R	CEFAS	73	19		1	1						
	Ernest Shackleton		1995	22	G	BAS- uk	80	45			1						1
	James Clark Ross		1991	26	G	BAS- uk	99,04	50	1	1	1			1			1
	James Cook		2006	11	G	NERC	89,2	32	1	1	1		1	1			1
	Prince Madog		2001	16	CR	Bangor Univ.	34,09	10		1	1						
	Scotia		1998	19	R	Scottish Governmei	68,6	12		1	1						

10.3 Appendix 3 - Technical capacity of European Research vessels (source: EUROFLEETS2 project)

Eurofleets

		1960 – 1970 – 1980 – 1990 – 2000 – 2010 – 2020 – 2030	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technicians	Technical capacity: Phys 1	Phys2	Phys 3	Phys 4	Phys 5	C10'	C20'	DP	Sub. Pst	VSAT	Lab	R / A	Sub
BELGIUM	Belgica	Belgica 2020	1984	33	R	RBINS	50,9	12 - 16	x	x	x	x			2		x	x	5	1 / 1	
	Simon Stevin	Simon Stevin	2012	5	C	VLIZ	36	10	x	x	x	x		1	1	x	x	x	2	1 / 1	
BULGARIA	Akademik	Akademik	1979	38	R	IO-BAS	55,5	22		x	x	x			1		x		3	1 / 1	x
CROATIA	Bios Dva	Bios DVA	2009	8	C	IOF	36,6	18	x	x	x	x		1					2		
	Palagruza	Palagruza	1975	42	R	HIRC	45,5	40		x	x	x							3	1 / 1	
	Hidra	Hidra	1994	23	C	HIRC	22,1	6		x		x		2	1		x		1	1 / 1	
DENMARK	Aurora	Aurora	2014	3	C	Aarhus Univ.	28	14		x	x					x			2	1 / 0	
	Dana	Dana	1981	36	O	DTU aqua	78,43	10	x	x	x	x	x	3	0			x	5		
ESTONIA	Salme	Salme	1974	43	CR	TUT	31,3	12	x	x	x	x							2	0 / 1	
FAROE ISLANDS	Magnus Heinason	Magnus Heinason 2019 New Magnus Heinason	1978	39	R	FAMRI	44,5		x	x	x	x	x					x	2	0 / 1	
FINLAND	Aranda	Aranda	1989	28	O	SYKE	59,2	27	x	x	x	x	x	2	2	x		x	5	1 / 0	
France	Alis	Alis	1987	30	CR	IRD	28,4	6													
	Antéa	Antea	1995	22	R	IRD	34,95	10	x	x	x	x			1		x		3	1 / 0	
	Beautemps-Beaupré	Beautemps-Beaupré	2002	15	O	French Navy	80,64	25	x	x	x	x	x		4	x	x	x	3		
	Côtes de la Manche	Côtes de la Manche	1997	20	C	CNRS	24,9	8	x	x		x		1			x		1		
	L'Astrolabe	L'Astrolabe 2018 New L'Astrolabe	1986	31	O	IPEV	65	50													
	L'Atalante	L'Atalante	1990	27	G	Ifremer	84,6	29	x	x	x	x	x		8	x	x	x	8	1 / 1	x
	L'Europe	L'Europe	1993	24	R	Ifremer	29,6	8		x	x	x			1		x	x	1	1 / 1	
	Marion Dufresne	Marion Dufresne	1995	22	G	IPEV	120,5	110	x	x	x	x	x		50	x	x	x	x		
	Pourquoi pas?	Pourquoi pas?	2005	12	G	Ifremer	107,7	40	x	x	x	x	x		20	x	x	x	5	1 / 1	x
	Thalassa	Thalassa	1996	21	O	Ifremer	74,5	25	x	x	x	x	x		5	x	x	x	4	1 / 1	
	Thalia	Thalia	1978	39	C	Ifremer	24,5	6	x	x	x	x			1		x		1		
	Thetys II	Thetys II	1993	24	CR	CNRS	24,9	10	x	x	x	x		1		x		1			
GERMANY	Alkor	Alkor	1990	27	R	GEOMAR	54,59	12			x	x			2			x	3	1 / 1	
	Elisabeth Mann Borgese	Elisabeth Mann Borgese	1987	30	R	IOW	56,5		x	x	x							x	3		
	Heincke	Heincke	1990	27	R	AWI	54,59	12	x	x	x	x		1	2		x	x	3		
	Littorina	Littorina	1975	42	C	GEOMAR	29,82	6		x									1		
	Ludwig Prandtl	Ludwig Prandtl	1983	34	C	HZG	32,5	10													
	Maria S. Merian	Maria S. Merian	2006	11	G	LDF	94,8	22	x	x	x	x	x	1	21	x	x	x	13	1 / 1	x
	Meteor	Meteor	1986	31	G	LDF	97,5	30	x	x	x	x	x	3	15	x	x	x	18	1 / 1	x
	Polarstern	Polarstern	1982	35	G	AWI	118	55	x	x	x	x	x		32		x	x	13	1 / 1	x
	Poseidon	Poseidon	1976	41	O	GEOMAR	60,7	11		x	x				1				3	1 / 1	x
	Solea	Solea	2004	13	CR	TI	42,4	7													

Country	Vessel	Timeline (1960–2030)	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technicians	Phys 1	Phys2	Phys 3	Phys 4	Phys 5	C10'	C20'	DP	Sub. Pst	VSAT	Lab	R / A	Sub
									Technical capacity												
	Sonne	*Sonne*	2014	3	G	LDF	97,94	25	x	x	x	x	x	5	27	x	x	x	24	1 / 1	x
	Walther Herwig III	*Walther Herwig III*	1993	24	R	TI	64,5	12													
GREECE	*Aegaeo*	*Aegaeo*	1985	32	R	HCMR	61,5	21	x	x	x	x	x	1	1		x	x	3	1 / 1	x
	Philia	*Philia*	1986	31	C	HCMR	26,1	6		x		x	x					x	1	1 / 1	
GREENLAND	*Paamiut*	*Paamiut*	1971	46	R	NATUR	58,6	12	x	x	x								2		
	Sanna	*Sanna*	2012	5	R	NATUR	32,35	10	x	x	x	x							2		
ICELAND	*Arni Fridriksson*	*Arni Fridriksson*	2000	17	R	MRI	69,9	16		x											
	Bjarni Saemundsson	*Bjarni Saemundsson*	1970	47	R	MRI	56	13		x	x										
ITALY	*Andrea*	*Andrea*	1999	18	C	Bologna Univ.	29,2	8											2		
	G. Dallaporta	*Dallaporta*	2001	16	CR	CNR	35,7	12		x	x	x				x		x	3		
	Italica	*Italica* 2017	1981	36	G	PNRA	130	92	x	x	x	x	x	16	81			x	15		
	Minerva Uno	*Minerva Uno*	2002	15	R	CNR	46,6	13	x	x	x	x		2		x	x	x	2	1 / 1	
	OGS-Explora	*OGS-Explora*	1973	44	O	OGS	72,63	24	x	x	x	x	x	3	3			x	4		
IRELAND	*Celtic Explorer*	*Celtic Explorer*	2002	15	O	MI	65,5	19-21	x	x	x	x	x	12	8	x	x	x	4	1 / 1	
	Celtic Voyager	*Celtic Voyager* 2019 replacement	2002	15	R	MI	31,4	8	x	x	x	x		1			x	x	3	1 / 1	
LITHUANIA	*Mintis*	*Mintis*	2014	3	CR	Klaipeda Univ.	39	12													
NORWAY	*Dr. Fridtjof Nansen*	*Dr. Fridtjof Nansen 2017 New Fridjof Nansen*	1993	24	O	IMR	56,8	20	x	x		x	x		1			x	3	1 / 0	
	G.M. Dannevig	*G.M. Dannevig*	1979	38	C	IMR	27,85	12		x											
	G.O.Sars	*G.O.Sars*	2003	14	O	IMR	77,5	30	x	x	x	x	x	3	1	x		x	10	1 / 1	
	Gunnerus	*Gunnerus*	2006	11	C	NTNU	31,25	20													
	Hakon Mosby	*Haakon Mosby* 2016 *Kristine Bonnevie (Dr. Fridtjof*	1980	37	R	IMR	47,24	16	x	x		x	x			x		x	2	1 / 0	
	Helmer Hanssen	*Helmer Hanssen*	1992	25	O	NCFS-UT	63,8	29	x	x	x	x		OD	OD			x	5	1 / 0	
	Johan Rudd	*Johan Rudd*	1976	41	CR	NCFS-UT	30,5	11		x	x							x	2	1 / 0	
	Johan Hjort	*Johan Hjort*	1990	27	O	IMR	64,4	22	x	x		x	x			x		x	4	1 / 0	
	Lance	*Lance* 2016 *Konprins Haakon*	1978	39	O	NPI	60,8	25	x	x	x								4		
NETHERLANDS	*Navicula*	*Navicula*	1981	36	C	NIOZ	24	8													
	Pelagia	*Pelagia*	1990	27	G	NIOZ	66	15	x	x	x	x	x		9	x	x	x	4	1 / 1	
	Tridens	*Tridens*	1990	27	R	R-GSC	73,54	13	x	x	x										
POLAND	*Baltica*	*Baltica*	1993	24	CR	NFMRI	41	11	x	x	x	x						x	7		
	Imoros 1	*Imoros 1*	1967	50	C	Maritime Institut	20,7	8	x	x	x								1		
	Imor	*Imor*	2006	11	CR	Maritime Institut	32,5	16		x	x	x			1	x	x		1	1 / 0	
	Oceania	*Oceania*	1985	32	R	IO-PAS	48,9	14	x	x	x	x						x	5	1 / 0	

		1960 1970 1980 1990 2000 2010 2020 2030	Y.B	Age	Class	Institutional operator	Length (m)	Scientists + technicians	Technical capacity												
									Phys 1	Phys2	Phys 3	Phys 4	Phys 5	C10'	C20'	DP	Sub. Pst	VSAT	Lab	R / A	Sub
PORTUGAL	Almirante Gago Coutinho	Almirante Gago Coutinho	1985	32	R	IH	68,2	15	x	x	x					x				1 / 1	
	Arquipelago	Arquipelago	1993	24	C	IMAR/DOP-UAC	25	6	x	x	x					x				1 / 0	
	Dom Carlos I	Dom Carlos I	1989	28	R	IH	68,7	15	x	x	x									1 / 0	
	Noruega	Noruega	1978	39	R	IPIMAR	47,5	12													
ROMANIA	Mare Nigrum	Mare Nigrum	1971	46	R	GeoEcoMar	82	25	x	x	x	x		1	2			x	8	1 / 1	
SPAIN	Ángeles Alvariño	Ángeles Alvariño	2012	5	R	IEO	46,7	13	x	x	x		x	2	2	x	x	x	4	1 / 1	
	Francisco de P. Navarro	Francisco de P. Navarro	1987	30	C	IEO	30,5	7	x	x	x	x	x	1					2		
	Garcia del Cid	Garcia del Cid	1977	40	CR	CSIC	37,2	12	x	x	x	x	x	1			x	x	2		x
	Hesperides	Hesperides	1991	26	G	CSIC	82,5	37	x	x	x			2	1			x			
	Miguel Oliver	Miguel Oliver	2007	10	O	SGPM	70	24		x	x	x	x		1	x		x	3		
	Mytilus	Mytilus	1996	21	C	CSIC	24	10	x	x	x	x							2		
	Ramón Margalef	Ramón Margalef	2011	6	R	IEO	46,7	11	x	x	x		x	2	2	x	x	x	4	1 / 0	
	Sarmiento de Gamboa	Sarmiento de Gamboa	2007	10	O	CSIC	70,5	25	x	x	x	x	x	10	5	x	x	x	4	1 / 1	x
	Vizconde de Eza	Vizconde de Eza	2000	17	R	SGPM	53	16	x	x	x		x			x			4	1 / 0	
SWEDEN	Fyrbyggaren	Fyrbyggaren	1976	41	R	Stockholm Univ.	42														
	Electra	Electra	2016	1	C	Stockholm Univ.	24,3		x	x	x			1					1		
	KBV181	KBV181	1991	26	C	Umea Univ.	56	8		x	x					x			1		
	Oden	Oden	1988	29	G	SPRS	107,8	50		x	x	x	x	4	23			x	14		
	Skagerak	Skagerak Replaced by New Skagerak in 2017	1968	49	R	Göteborg Univ.	38,7	16	x	x	x										
	Ocean Surveyor	Ocean Surveyor	1984	33	R	Swedish Geolog	37														
TURKEY	Alemdar II	Alemdar II Refit in 2012	1966	51	R	Istanbul Univers	63,4	24	x	x	x	x							3		
	Bilim 2	Bilim 2	1983	34	R	IMS	40,36	14	x	x	x								2	1 / 1	
	Koca Piri Reis	Koca Piri Reis	1978	39	R	IMST-DEU	36	12		x	x								1		
	Tubitak Marmara	Tubitak Marmara	2013	4	R	MAM/EMSI	41,2	11	x	x	x			1	1	x	x		3	1 / 1	
	Surat Arastirma I	Surat Arastirma I	1984	33	C	Central Fisherie:	28,4	10													
	Karadeniz Arastirma	Karadeniz Arastirma	2016	1	C	FFAS/RTEU	25	12	x		x								3		
	Seydi Ali Reis	Seydi Ali Reis	2012	5	C	FFAS/SU	22,2	5	x	x										1 / 1	
	KTU Denar I	KTU Denar I Refit in 2014 (Denar I since 1989)	1989	28	C	IMS/KTU	32,47	11	x	x	x								3		
	Yunus S	Yunus S	1994	23	C	IMS/IU	32	12		x	x								3		
UNITED KINGDOM	Corystes	Corystes	1988	29	R	AFBINI	52,5	11	x	x	x	x		1					4	1 / 0	
	Discovery	Discovery	2013	4	G	NERC	99,7	28	x	x	x	x	x			x	x	x	5	1 / 1	
	Endeavour	Endeavour	2003	14	R	CEFAS	73	19	x	x	x					x		x	4	1 / 1	
	Ernest Shackleton	Ernest Shackleton	1995	22	G	BAS- uk	80	45								x					
	James Clark Ross	James Clark Ross	1991	26	G	BAS- uk	99,04	50	x	x	x								6		
	James Cook	James Cook	2006	11	G	NERC	89,2	32	x	x	x	x	x		7	x	x	x	6	1 / 1	
	Prince Madog	Prince Madog	2001	16	CR	Bangor Univ.	34,09	10	x	x	x	x						x	2	1 / 0	
	Scotia	Scotia	1998	19	R	Scottish Goverr	68,6	12													

10.4 Appendix 4 - Global, Oceanic, Regional Vessels /versus scientific ROVs (source: EMSO PP)

			ROV									
RVs	Country	Length	Holland	Quest	Victor 6000	Isis	IEO	Aglantha	Max Rover	Kiel 6000	ROV Phoca	MeBo
			3000 m	4000 m	6000 m	6500 m	2000 m	2000 m	2000 m	6000 m		
Pourquoi pas?	France	107.60 m										
Thalassa	France	74.50 m										
Meteor	Germany	97.50 m										
Sarmiento de Gamboa	Spain	70.50 m										
Discovery (new)	United Kingdom	100.00 m										
Polarstern	Germany	118.00 m										
NRP D. Carlos I	Portugal	68.70 m										
L'Atalante	France	84.60 m										
James Cook	United Kingdom	89.50 m										
Celtic Explorer	Republic of Ireland	65.50 m										
G.O. Sars	Norway	77.50 m										
Sonne	Germany	97.94 m										
Maria S. Merian	Germany	94.80 m										
Poseidon	Germany	60.70 m										
Pelagia	Netherlands	66.00 m										
Aegaeo	Greece	61.50 m										
Alkor	Germany	54.59 m										
Heincke	Germany	54.59 m										
Marion Dufresne	France	120.50 m										
OGS-Explora	Italy	72.63 m										
Mare Nigrum	Romania	82.20 m										
James Clark Ross	United Kingdom	99.04 m										
Hesperides	Spain	82.50 m										
Italica	Italy	130.00 m										
NRP Almirante Gago Coutinho	Portugal	68.20 m										
Ernest Shackleton	United Kingdom	80.00 m										
Tridens	Netherlands	73.54 m										
Beautemps-Beaupré	France	80.64 m										
Miguel Oliver	Spain	70.00 m										
Cornide de Saavedra	Spain	66.70 m										
Le Suroit	France	56.34 m										
Urania	Italy	61.30 m										
Dr. Fridtjof Nansen	Norway	56.80 m										
Jan Mayen	Norway	63.80 m										
Johan Hjort	Norway	64.40 m										
Akademik	Bulgaria	55.50 m										

LEGEND	
	Proven deployment on RV
	Possible deployment of ROV with minor modifications
	To be queried to vessel operator – No obvious capacity to deploy ROV
	Cannot deploy ROV, e.g. RV not available or no D.P.
	No information available

10.5 Appendix 5 - ENVRIPLUS Questionnaire: need of European Oceanographic fleet

Full replies to the questionnaire are included in a separate document which is made available to the ENVRIPLUS project. It is uploaded on the Activ Collab project site.

This questionnaire is meant to collect your professional knowledge related to the ENVRIplus research infrastructures which you are connected to. As we can also collect your name, position and professional position and potentially other personal information, it is important that you understand the reason and procedure of this questionnaire. Information on ENVRIplus project: (http://www.envriplus.eu)

ENVRIPLUS is a cluster project, funded by the European Commission Horizon 2020 programme, on collaboration of research infrastructures (RIs) in Environmental and Earth System sciences, built around ESFRI roadmap and associating leading e-infrastructures and Integrating Activities together with technical specialist partners. ENVRIPLUS is driven by 3 overarching goals: 1) favouring crossfertilization between infrastructures, 2) implementing innovative concepts and devices across RIs, and 3) facilitating research and innovation in the field of environment to an increasing number of users outside the RIs. ENVRIPLUS organizes its activities along a main strategic plan where sharing multidisciplinary expertise will be most effective. It aims to improve Earth observation monitoring systems and strategies, including actions towards harmonization and innovation, to generate common solutions to many shared information technology and data related challenges, to harmonize policies for access and provide strategies for knowledge transfer amongst RIs. ENVRIPLUS develops guidelines to enhance transdisciplinary use of data and data products supported by applied use cases involving RIs from different domains. ENVRIPLUS coordinates actions to improve communication and cooperation, addressing Environmental RIs at all levels, from management to end-users, implementing RI staff exchange programs, generating material for RI personnel, and proposing common strategic developments and actions for enhancing services to users and evaluating the socioeconomic impacts. ENVRIPLUS is expected to facilitate structuration and improve quality of services offered both within single RIs and at pan RI level. It promotes efficient and multidisciplinary research offering new opportunities to users, new tools to RI managers and new communication strategies for environmental RI communities. The produced solutions, services and other project results are made available to all environmental RI initiatives, thus contributing to the development of a consistent European RI ecosystem.

Responsible person for this questionnaire: Rolin Jean-François, Jean.François.Rolin@ifremer.fr, IFREMER

You can always ask for further information from the responsible person above, or from the ENVRIplus project office: envriplus-coordination@helsinki.fi. This questionnaire aims at providing information on the needs of European Infrastructures for the European Oceanographic fleet. Answering the questionnaire is voluntary and you can stop answering at any moment. The questionnaire is a WORD document, which will remain in this form, and will take approximately less than 30 minutes to answer. You have been selected to answer the questionnaire as your professional capacity as the representative of the RI you are working with. A synthesis of all information collected from this questionnaire will be sent to all contributors.

Your personal information: name, contact information, organization, and position in your organization are stored for analysis purposes.

All data will be stored securely on an Ifremer disk homedir4\envriplus and will only be used within the framework of the ENVRIplus project. Access to the answers is restricted to the responsible person and the data analyzers selected by him/her. The answers will be analyzed offline. The questionnaire technical results and conclusions deducted from the results can be published within the ENVRIplus project deliverables, reports and documentation, however no personal information will be published in any form. All questionnaire answers will be deleted latest at the end of the ENVRIplus project. If your contact information is stored with your answers, you can also request to be informed on the reports and documents generated from the information collected in this questionnaire.

1) Contact information

Name:
Position:
Contact information:

2) Site or/and area of intervention

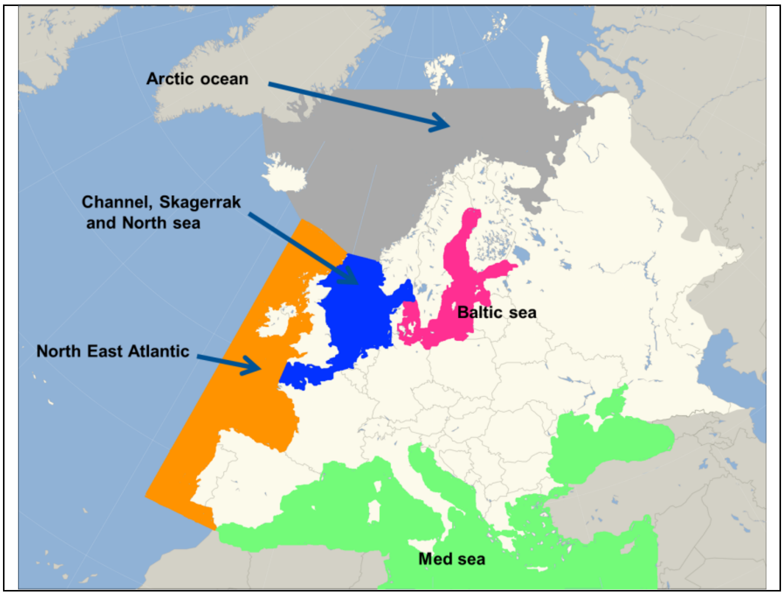
<u>Area of intervention</u>, choose among the following characters

Oceans to which the database refers to are:

- Artic ocean;
- Southern ocean;
- Indian ocean;
- Pacific ocean;
- Atlantic ocean (including north sea, Baltic sea and Mediterranean sea).

In Europe, 4 maritime areas have been considered in reference to OHI (International Hydrographic Organization) geographical limits (except for North East Atlantic which is an invention):

- Mediterranean sea (including Black sea, sea of Ozoz and Marmara sea);
- Skagerrak, North sea and channel;
- Baltic sea;
- North East Atlantic.



European maritime areas considered in EUROFLEETS2 database

<u>Site of intervention</u>, *be the more precise as possible (GPS coordinates…)*

3) Size of wish ship

Please choose among the following characters

Ship class	Global (G)	Ocean (O)	Regional (R)	oastal (CR and C)	Local (L)
Length (m)	> 80 m	80 m ≥ L ≥ 60 m	70 m ≥ L ≥ 30 m	45 m ≥ L ≥ 20 m	40 m ≥ L ≥ 15 m
Science berths (including scientists and non permanent technicians)	> 25	> 20	> 10	> 5	> 5

Comments:

4) Technical capacities needed

Please choose among the following characters

Parameters	Class	Your need
ADCP	Phys 1	
Small CTD deployment	Phys 2	
CTD Rosette deployment	Phys 3	
Light mooring capacity (< 1000 m)	Phys 4	
Heavy mooring capacity (> 1000 m)	Phys 5	
Container 10' (number)	C 10'	
Container 20' (number)	C 20'	
Dynamic positioning	DP	
Submersible positioning	Sub Pst	
VSAT transmission to shore	VSAT	
Laboratory (number)	Lab	
Underwater Vehicles ROV or AUV capabilities or submersibles	R/A	

Comments:

5) Number of ship days needed for each intervention:

Comments:

6) Frequency of the need during the next 10 years:

Example : yearly frequency starting in 2018

Comments:

10.6 Appendix 6 – List of Research Infrastructures which participated to the ENVRIPLUS questionnaire

RI	Stations, nodes, sites
EMSO	EMSO-Marmara EMSO-Nice EMSO-Azores EMSO-Ligure EMSO-Molène EMSO-Galway EMSO-Azores Condor EMSO-Hellenic EMSO-Portugal PLOCAN
PIRATA	France
EMBRC	North Sea North East Atlantic Mediterranean Sea
EPOS	
KM3Net	KM3Net Italy KM3Net Greece KM3Net France
ECORD	
FIXO3	PAP Station M

10.7 Appendix 7 – EMBRC ships

Vessel name	Type of vessel	Size	Operator	Area of operation
Rigid Zodiac	RIB	6 m	Plentzia Marine Station, University of the Basque	Estuaries of Basque coast
UPV/EHU	Vessel		UPV/EHU Nautic School	Southern Biscay Bay
Pelagia	Vessel	5.5 m	University of Vigo	Southern Galicia
Fulespid	Vessel	5.5 m	University of Vigo	Southern Galicia
Kraken	Vessel	7.5 m	University of Vigo	Southern Galicia
RIB Zeekat	RIB	6 m	Flanders Marine Institute	Belgian Coast, Schelde estuary
MBA Sepia	Vessel	15.4 m	Marine Biological Association of the UK	South West United Kingdom
Vettoria	Vessel	19 m	Stazione Zoologica Anton Dohrn di Napoli	Gulf of Naples
Ippocampo	Vessel	7.5 m	Stazione Zoologica Anton Dohrn di Napoli	Gulf of Naples
Phoenicia	Vessel	10 m	Stazione Zoologica Anton Dohrn di Napoli	Ischia
RUFI II	Vessel	7.5 m	Oceanographic Observatory of Banyuls sur mer	Banyuls Bay
NEREIS II	Vessel	15 m	Oceanographic Observatory of Banyuls sur mer	Côte Vermeille
Aurelia	Vessel		Station Biologique de Roscoff	Brittany
Zoé	Vessel		Station Biologique de Roscoff	Brittany
Neomysis	Vessel		Centre Nationale de la Recherche Scientifique-Institut National des Sciences de l'Univers	Brittany
Sagita III	Vessel	12 m	Institut National des Sciences de l'Univers	Villefranche sur mer Bay
Velelle	Vessel	7 m	Institut National des Sciences de l'Univers	Villefranche sur mer Bay
Pelagia	Vessel	6 m	Oceanographic Observatory of Villefranche sur mer	Villefranche sur mer Bay
Litus	Vessel	12 m	Istituto di scienze marine Venice	Lagoon of Venice and Northern Adriatic Sea
RV Sam Riothberg	Vessel	16 m	Interuniversity Institute for Marine Sciences	Gulf of Eilat
ALKYON	Vessel	13.4 m	Helenic Centre for Marine Research	Aegean and Ionian
Vessel 4	Boat	5 m	Instituto di Scienza Marine	Ligurian Sea
Vessel 5	Vessel	10 m	Istituto Nazionale di Oceanografia e Geofisica	Gulf of Naples
Luigi Sanzo	Vessel	10 m	Istituto per l'ambiente marino costiero Sede	Central Mediterranean Sea
Bio4U	Vessel	7.5 m	Istituto per l'ambiente marino costiero Sede	Sicily
RIB	Boat	5 m	Istituto per l'ambiente marino costiero Castellammare	Gulf of Castellammare
Balistes	Boat	5.95 m	Centre of Marine Sciences	Algave coasal an transitional waters
Pagrus	Vessel	8.3 m	Centre of Marine Sciences	Algave coasal an transitional waters
RIB at Rothera	RIB		British Antarctic Survey	Marguerite Bay
Calanus	Vessel	20 m	Scottish Association for Marine Science	West Coast, Inner Hebrides & Clyde
Seol Mara	Vessel	12 m	Scottish Association for Marine Science	Inshore waters around OBAN
Swordsman	Vessel	7.5 m	Scottish Ocean Institute	Trailable, then < 20 km of safe haven
Tuimelaar	RIB	6.5 m	Royal Belgian Institute for Natural Sciences	Belgian part of the North Sea