MINKE's Transnational and Virtual Access

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***Abstract*— MINKE (Metrology for Integrated marine maNagement and Knowledge-transfer nEtwork) is an european project funded under Call H2020-INFRAIA-2018-2020 and Topic INFRAIA-02-2020 Research and Innovation action. MINKE project integrates key European marine metrology research infrastructures, to coordinate their use and development and propose an innovative framework of "quality of oceanographic data" for the different European actors in charge of monitoring and managing the marine ecosystems. MINKE proposes a new vision in the design of marine monitoring networks considering two dimensions of data quality, accuracy and completeness, as the driving components of the quality in data acquisition. The project through the different Integration Activities (Networking, Transnational-Virtual Access and Joint Research), aims to lay the groundwork for creating the necessary synergies among the different involved actors, creating a new community with complementary capabilities for Ocean & Coastal Observation, that will facilitate the transition towards a blue growth socio-economic system.**

This paper presents the activities related to the Transnational and Virtual Access services offered through the project.

Keywords*— *calibration facility, metrology for the sea, Transnational Access

I. Transnational access to European Research Infrastructures

Research Infrastructures are facilities, resources and services used by the science community to conduct research and foster innovation [1] Research Infrastructures, including e-infrastructures, are at the core of the knowledge triangle of research, education and innovation and therefore play a vital role in the advancement of knowledge and technology and their exploitation. Research Infrastructures are also crucial in helping Europe lead a global movement towards open, interconnected, data-driven and computer-intensive research, experimental development, as well as education and training.

European researchers need effective and convenient access to the best research infrastructures in order to conduct research for the advancement of knowledge and technology. Horizon 2020 Research Infrastructures actions aim to bring together, integrate on European scale, and open up key national and regional research infrastructures to all European researchers, from both academia and industry, ensuring their optimal use and joint development.

The following Research Infrastructures projects related to offers free access: either transnational access, based on call for proposals, or virtual access (online services). These opportunities are publicized widely by each individual project, in particular on their web site.

Some of the most recent projects related to marine environment offering TNA services are listed below:

- Network of Leading European AQUAtic MesoCOSM Facilities Connecting Mountains to Oceans from the Arctic to the Mediterranean (AQUACOSM)
- HYDRALAB+ Adapting to climate change (HYDRALAB-PLUS)
- Joint European Research Infrastructure network for Coastal Observatory – Novel European eXpertise for coastal observaTories (JERICO-NEXT, JERICO-S3)
- Implementation of the Strategy to Ensure the EMSO ERIC's Long-term Sustainability (EMSO-Link)
- SeaDataCloud - Further developing the pan-European infrastructure for marine and ocean data management (SeaDataCloud)
- Environmental Research Infrastructures Providing Shared Solutions for Science and Society (ENVRI PLUS)
- European Marine Biological Research Infrastructure Cluster to promote the Blue Bioeconomy (EMBRIC)
- Association of European Marine Biological Laboratories Expanded (ASSEMBLE Plus)
- AQUAculture infrastructures for EXCELlence in European fish research towards 2020 (AQUAEXCEL2020)
- Marine Renewable Infrastructure Network for Enhancing Technologies 2 (MARINET2)
- European Infrastructure Powering the Internet of Things (EnABLES)

In terms of access to calibration facilities, it was during JERICO project that labs around Europe were opened to the wider users for first time. This continued in the follow up projects (JERICO NEXT and JERICO S3) giving Transnational Access to a number of unique Calibration Facilities for international research and technology development. Furthermore, the JERICO Calibration working group through a respective action in the framework of JPI Oceans Strategic Research and Innovation Agenda (SRIA) promoted the establishment of a permanent working group for calibration activities, proposing a future strategic plan towards a pan-European calibration grid in support of marine observations.

II. Minke transnational access activities

MINKE integrates key European metrology marine research infrastructures, to promote their coordinated use and development and thereby help the European EOVs monitoring sector face the challenge of sustainable management of marine ecosystems. Covering all the relevant scientific fields and the diversity of marine ecosystem environments, MINKE provides the different involved actors (academic, private research communities, industry, civil associations) with easy access to high quality services and resources. These are needed to develop innovative and ethical solutions for ocean health and thus efficient management of marine resources, improve the overall measurement quality of EOVs and promote sustainable competitiveness and blue growth.

At the networking level, MINKE will allow better use of existing research infrastructures (RIs) and stimulate

collaboration across research fields, production systems, and national borders. In particular, the project will provide a system for harmonized and optimized Access to state-of-the-art marine RIs, including those linked with citizen science (trough Transnational TNA or Virtual VA access), for any relevant scientific field, and develop and implement a TNA-VA program that places MINKE RIs at the center of addressing key European research challenges in a coordinated way.

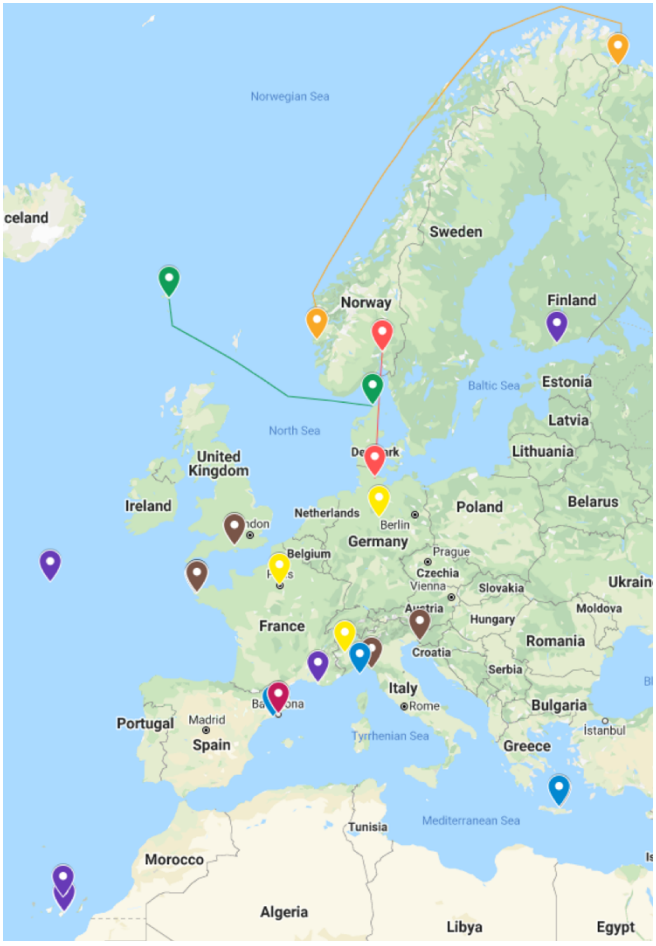
At the transnational and virtual access level, MINKE will promote key EU marine calibration, experimental facilities and participatory platforms to provide effective and convenient access to the 16 MINKE key research infrastructures for marine observation research by the academic and private sectors; to. reach out to new users by publicizing widely the calls for access and promoting equal opportunities (e.g. Southern and Eastern European countries); and to select TNA-VA applications according to their excellence, feasibility, scientific priorities, and follow the principles of transparency, fairness and impartiality (e.g. gender issues).

MINKE foresees a close connection and maximizing synergy between the three main activities Networking (NA), Transnational access/Virtual Access (TNA/VA) and Joint Research (JRA). NA will emphasize technological and procedural harmonization by formulating standards and common references, as well as common protocols for operational procedures, and guidelines of best practices. As well, Data management and harmonization will establish standardization, interoperability and compliance with international and existing European initiatives. Moreover, in order to further consolidate and promote the synergy between European research communities, it is essential to actively enhance international and national collaborations with related projects, networks and stakeholders. JRA will improve the quality of measurement methods (maximizing accuracy and completeness) for a broad variety of EOVs, that currently lack clear calibration protocols to achieve the required in- situ data accuracy, which will directly feed back to the NA and TNA/VA. In return, NA will benefit from all these inputs to elaborate an EU strategy for a future network of marine metrology.

Access will be provided only to key research infrastructures of European interest, i.e., those infrastructures able to attract significant numbers of users from countries other than the country where they are located. All research infrastructures involved in MINKE (combining metrological and participatory systems) are of European and worldwide interest. Figure 1 shows these facilities by country and Table 1 by institution. Their involvement in many national, European and international projects or ERICs with academic and private partners, and the support provided by their high-level scientists, guarantees their attractiveness to significant numbers of users from the wider scientific communities in Europe and elsewhere where research for improving marine observation sustainability is limited by the lack of appropriate RI. The mapping of all marine metrological and participatory RIs and capabilities in European countries will favour networking activities with similar RIs outside the partnership. MINKE standards and common guidelines will be widely shared to ensure unified practices inside and outside Europe. Moreover, MINKE will give the unique opportunity to users to access more than one RI for the same project.

III. MINKE FACILITIES

Transnational Access MINKE is offering a comprehensive "package" of resources for TNA that embraces infrastructure, technical expertise, and topical on-site assistance if requested. The package is directed towards supporting the potential R&D-related demands of actors from research, industry and the services sector involved in marine observing activities belonging to both the public and the private spheres. The MINKE TNA package includes eight established laboratories for calibrating instruments and investigating technology, some with metrology-level capabilities for specific marine measurands, as well as four actives in-situ marine observing "installations" for testing and/or validating equipment in the field.



TNA Calibration Laboratories

- ID1.1 METLAB, IFREMER
- ID3.1 NMFCL, NOC
- ID3.2 FTIR Imaging Facility, NOC
- ID4.2 ISC-Lab, CNR ISMAR
- ID5.1 DMCO Magnetics, Shom
- ID5.2 DMCO Temp, Shom
- ID5.3 DMCO HPLC, Shom
- ID6.1 PCL, HCMR
- ID8.1 CTMO, OGS

TNA FerryBox

- ID7.1 NorSOOP/NorFerry Color Fantasy
- ID7.1 NorSOOP/NorFerry M/S Trollfjord
- ID7.1 NorSOOP/NorFerry M/S Norrona

TNA Marine Observatories

- ID2.1Obsea, UPC
- ID4.1 W1M3A, CNR
- ID6.2 Coastal Buoy, HCMR

VA Facilities

- WP6 Fablab BCN, IAAC
- WP7 Natusfera

Supporting Facilities

- NMI INRiM, Italy
- NMI, LNE France
- NMI PTB, Germany
- SYKE Lab, Syke
- Plocan Facilities, Plocan
- Oceanic Platform, PLOCAN
- ESTOC, Plocan
- MIO, CNRS
- PAP, NOC

Figure 1: MINKE facilities offered under TNA and VA calls

The in-situ "installations" comprise one underwater coastal cabled observatory, one fixed-point marine observatory, one instrumented coastal buoy and a group of five FerryBox systems operating in different European sea areas. The combination of laboratories and in-situ infrastructure effectively accounts for all possible applicatory domains relating to measuring in the marine environment that could be of interest to a possible user or user group. Note that the laboratories providing access in MINKE will also be able to avail of assistance from the national metrological institutions participating in the project for additional or case-specific metrological guidance, should such a need arise.

In MINKE TNA is principally envisioned as a tool to help:

a) develop a conducive policy environment for seeding research-industry partnerships to drive Europe's productive capacities in the field of marine sensors and instrumentation;

b) establish technology "support institutions" to advise on product design, methodologies and quality control for marine sensors and instrumentation;

c) establish recognized reference material and performance assessment schemes for marine measurements;

d) establish international calibration chains and support international accreditation efforts for marine measurements.

IV. MINKE VIRTUAL ACCESS ACTIVITIES

Virtual Access activities will offer the support for the use of cost-effective technologies and web-based services to develop participatory monitoring projects that will enable users to conduct excellent research. The offered support will help on overcoming some of the potential barriers that the end-users needs to address for developing participatory programs:

• Technological barriers. The use of low-cost instruments, and in particular those based on the Do-It-Yourself (DIY) concept, require some technological skills that are not available to everyone interested in participatory monitoring programs that uses this type of technologies. Technological skills are required as well to set-up the data-transmission or data-storage systems. VA will facilitate the access to develop participatory monitoring without the need of having any of those technological skills, or providing virtual training in those cases that it may be required. VA will allow then the participation to any interested group, even for small NGOs or local civil organizations with very limited technological capacity.

• Knowledge barriers. In many cases participatory monitoring assume a minimum knowledge from the participants to report observations. For example, in a biodiversity monitoring where participants report lists of observed species, they should know how to identify those reported (or they need a previous training to identify them). The prior knowledge requirements to ensure a minimum reliability on the reported observations may significantly limits the number of participants (despite the fact that there may be a much greater number of people interested in participating, but who do not participate due to lack of this prior knowledge requirement). VA provides the specific tools and services that facilitate that any interested people may participate, without the need of any prior knowledge for participation, increasing the final completeness of the data sets.

• Community recruitment and engagement barriers. There is an implicit community linked to any participatory monitoring program. Building and maintaining such community requires a considerable effort, resources and expertise (dedicated community managers, the setup of the different media channels for information exchange and coordination of dedicated events to recruit and engage the people). These requirements represent a challenge (and in many cases a strong barrier) to set up new participatory projects. As an example Natusfera, the RI (citizen observatory) offered for VA in WP7, started officially in June 2016 and it took 2.5 years to reach "significant mass" of participation (more than 5.000 participants and 100.000 observations). At present (1.5 years later) the number of participants is nearly 13.000, which have reported over 240.000 observations. Virtual access to this kind off RIs offers the possibility to setup new participatory projects with a consolidated community, with the capability to reach the required completeness (i.e. a minimum set of observations) in relatively short periods of time.

Two modalities of virtual access have been proposed for the starting community in MINKE:

a) Virtual Access to participatory monitoring networks based on low-cost technologies. This VA will manage the access of existing validated low-cost hardware and give support communities in their experimentation campaign. This will be achieved by fostering the use of open hardware and software solutions, not only aiming to provide physical access to a set of sensors, but also supporting users in the different steps of the experimentation process, in order to progressively build up a more reliable, and valid source of environmental data, that can be later used in a dense data fusion network. To support this task, this VA will offer physical access to the low-cost instrumentation in different forms and ownership schemes, as well as virtual training (digital documentation such as MOOCs, video documentation and more traditional user guide formats). In addition, direct support schemes to facilitate the building, operation, network access and data analysis are proposed in order to cope with various ranges of users and backgrounds, trying to establish a strong connection with grassroot communities and researchers alike. These tasks will initially be carried out by IAAC, but will be consolidated into a knowledge platform as part of T6.4 that will serve as material for replication of this proposal in other Fablabs in the network. This strategy aims to build on existing solutions, with state-of-the-art technology in low cost instrumentation, data transmission and participatory sensing tools with long lasting experience such as Smart Citizen (IAAC), a leading open sensing project with more than 8 years of experience in the field.

b) Virtual Access to cloud based services (Citizen Observatories) to develop new participatory projects of biodiversity monitoring. As mentioned previously, this VA provide the opportunity to setup new projects in Natusfera, that will provide guided procedures and embedded quality control to allow the participation of anybody interested in collaborate. As a proof of concept, this VA will offer the support to develop new projects that will be focused on the monitoring target species, which are the ones that may require the highest completeness. Monitoring target species, particularly those considered harmful may have a high

economic impact due to the eradication cost, as it will be shown later in the impact section

Access provider short name	Short name of infrastructure	Short name
CSIC	Natusfera	MINKA
NIVA	NorSOOP	NorFerry
NIVA	NorSOOP	NRS
NOC	NMFCL	NMFCL
NOC	NOC-Plastics	NOC-Plastics
IAAC	Fablab	SCP-IAAC
IAAC	Fablab	SCH-IAAC
IFREMER	METLAB	METLAB
HCMR	PCL	Poseidon Calibration Lab
HCMR	HCB	Poseidon Heraklion Coastal buoy
UPC	OBSEA	OBSEA
OGS	OGS-CTMO	OGS-CTMO
CNR	CNR-W1M3A	W1M3A
CNR	CNR-ISC-Lab	ISC-Lab
Shom	DMCO	Currents calibration
Shom	DMCO	Temperature-salinity
Shom	DMCO	Pigments tests

Table 1: MINKE facilities by access provider

V. Conclusions

Accessing top level calibration and validation facilities will be a great opportunity through MINKE project for different communities working in the marine environment. Proposed projects and activities through the different TNA/VA calls will receive funding support to cover facilities expenses after proper review from an ad-hoc committee.

References

[1] Directorate-General for Research and Innovation (European Commission), “European charter of access for research infrastructures. Principles and guidelines for access and related services,” 2016. [Online]. Available: https://op.europa.eu/s/pjFE. [Accessed: 23-Jun-2021].