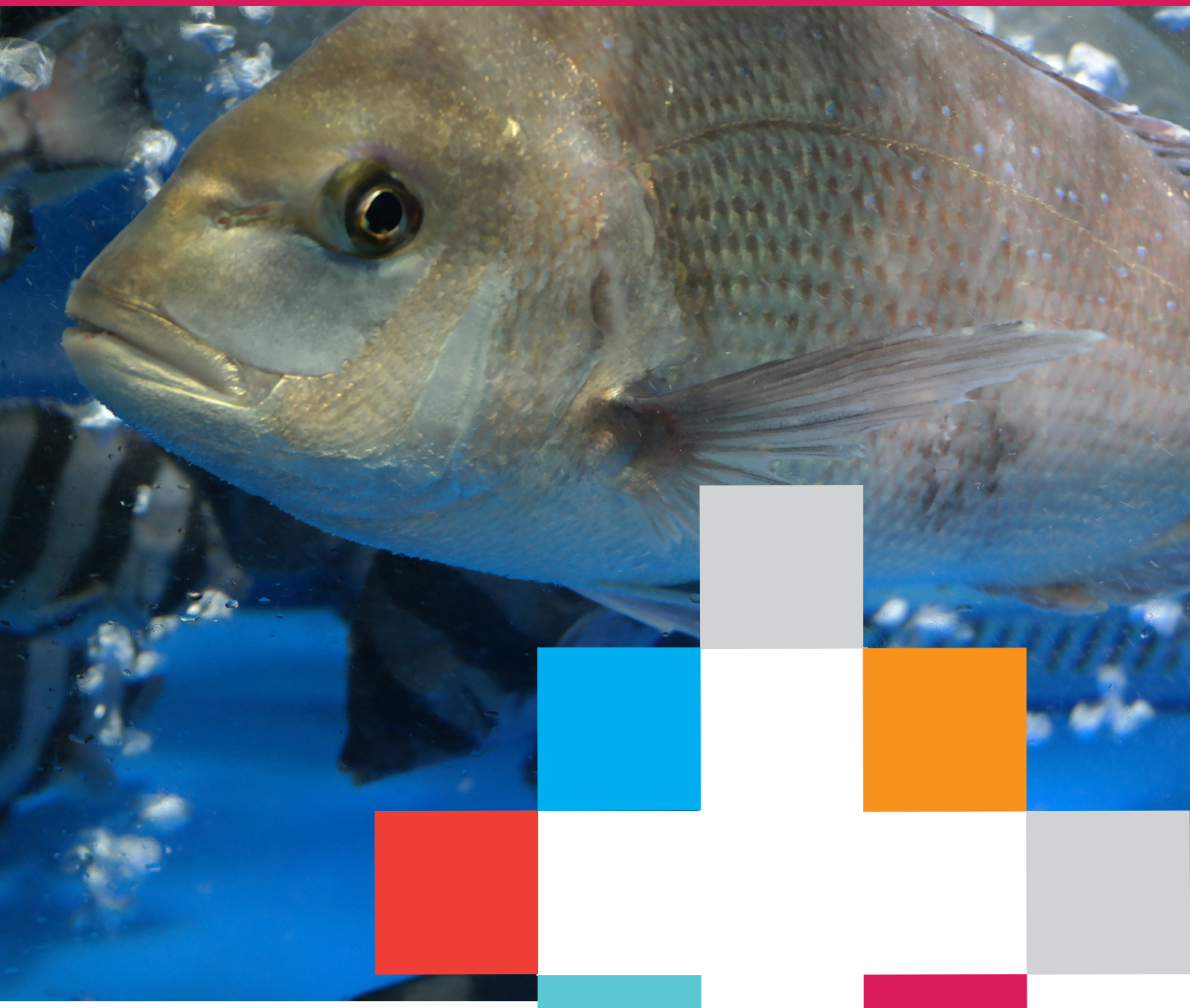
ASSEMBLE

ASSOCIATION OF EUROPEAN MARINE BIOLOGICAL LABORATORIES EXPANDED

ISSUE 5 | AUTUMN 2022

PROJECT NEWS



www.assembleplus.eu

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This newsletter has been developed to inform and update **ASSEMBLE Plus** partners and stakeholders on project activities. This is the fifth of five editions. External news items will be shared on the website: www.assembleplus.eu.

Coordinator's note: From ASSEMBLE Plus to EMBRC | *by Nicolas Pade (EMBRC, France).*

After five years, September 2022 marks the end of the Horizon 2020-funded project **ASSEMBLE Plus** (Association of European Marine Biological Laboratories Expanded) and EMBRC are ensuring the continuation of its legacy.

In 2009, the FP7-funded project, 'Association of European Marine Biological Laboratories' - ASSEMBLE, launched to create a network of key marine biological research stations around the European coastline. The goal was to enable European biologists to study a range of unique coastal ecosystems and a wide variety of marine organisms using the most advanced approaches in modern biology, providing paid access to the participating institutions (Transnational Access or TNA) for researchers. The project addressed the need for researchers to access both marine stations for experimental purposes and to gain access to marine organisms in an organised, predictable and open manner.

In parallel, a bid was prepared to create a research infrastructure for marine biological research. The goal was to bring together leading facilities in marine biological research to ensure that researchers would have long-term access to facilities, marine environments and biological resources beyond the scope of project funding. This led to the creation of the European Marine Biological Resource Centre (EMBRC), over the period 2011-2018. Today, EMBRC is Europe's leading research infrastructure for marine biological resources with a mission to support marine biological and ecological research as well as innovation. EMBRC also works to raise awareness of marine biological research, its application, and relevance for society and policy.

Building on the success of the original ASSEMBLE project, **ASSEMBLE Plus** launched in 2017. Led by EMBRC, the project broadened the scope of marine stations and research institutions available and continued offering funded access to the project partners through its TNA programme and four Networking Activities (NAs). The NAs covered the improvement of TNA provision and virtual access to marine biological stations' data, information and knowledge, facilitating engagement with user communities and the long-term sustainability of the marine stations. **ASSEMBLE Plus** also launched ambitious Joint Research Activities (JRAs) in support of novel research needs. The JRAs included new protocols for genetic manipulation and cryopreservation of marine organisms, genomic observatories, camera-based underwater surveying techniques, and novel experimental platforms.

With the goal of stimulating European excellence in fundamental and applied research in marine biology and ecology, **ASSEMBLE Plus** has improved our knowledge and technology bases for blue economy, policy and education purposes. The project integrated over 30 marine biological stations and installations from across Europe. Key achievements from the project include:

- Supporting over 500 research projects and scientists from around the world, enabling new strands of research by funding pilot projects.
- Introducing scientists to new facilities as well as offering training, networking and countless collaboration opportunities for hundreds of early career scientists.
- Creation of two new genomics observatories: Ocean Sampling Day (OSD) and Autonomous Reef Monitoring Structures - Marine Biodiversity Observation Network (ARMS-MBON).
- Development of open access protocols: Cryomar Protocol Toolbox for cryopreservation, and for the genetic transformation of novel emerging metazoan, macroalgal and microalgal model organisms and the deployment of CRISPR/Cas9 system for novel emerging metazoan, macroalgal and microalgal model organisms.
- Technical design specifications and guidelines for novel experimental platforms, deliverable coming soon.
- New survey techniques for diving: standard operating procedure guidelines for photogrammetry.
- Raising awareness among the scientific community of the importance of managing data under the FAIR and open access principles including the building of data workflows, catalogues and virtual environments.

Coordinator's note: From ASSEMBLE Plus to EMBRC (continued) | *by Nicolas Pade (EMBRC, France).*

- Providing significant insight into the strategic operations of marine stations and the environments in which they operate. This included strengthening and developing the marine stations' provision of services, building strong links between them and demonstrating their worth.

Post **ASSEMBLE Plus**, the genomic observatories are continuing as the European Marine Omics Biodiversity Observation Network (EMO BON), an EMBRC project aiming to enhance the European contribution to global genomic observation efforts. OSD will continue in another project, AtlantEco as All Atlantic Sampling Day.

Both ASSEMBLE and **ASSEMBLE Plus** have contributed significantly to the establishment, services, management and protocols of EMBRC. Half of **ASSEMBLE Plus** access providers are part of the EMBRC network meaning services will be maintained, there will be unlimited access and the legacy of **ASSEMBLE Plus** will continue through EMBRC. The platforms and protocols developed during **ASSEMBLE Plus** can be accessed through the EMBRC's Service Catalogue.

EMBRC enables researchers to better understand the ocean's biodiversity by facilitating access to marine organisms and their ecosystems, while providing the necessary services, facilities and other resources to support innovative research. Services are provided by more than 70 sites in ten member countries: Belgium, France, Greece, Israel, Italy, Norway, Portugal, Spain, Sweden and the United Kingdom. Read more about how to access EMBRC services or watch the ABCs of using EMBRC video.

In addition to providing various services, EMBRC contributes to European and international projects. Diverse in scope and country involvement, these projects aim to enhance EMBRC activities and/or services, strengthen collaboration with similar European organisations, structure the research community and provide services to support research. You can learn more about the projects EMBRC are involved in by visiting the EMBRC Projects page.

Training Course: FAIR Data for Marine Biologists | *by Katrina Exter (VLIZ, Belgium).*

An online training course entitled FAIR Data for Marine Biologists is now available on the OceanTraining Platform. The course addresses the basics of FAIR data – data which are Findable, Accessible, Interoperable and Reusable – with a focus on FAIR data produced by marine biologists. The course targets postgraduate students from master's degree level onwards.

The course was developed by **ASSEMBLE Plus** partner Flanders Marine Institute (VLIZ)'s Katrina Exter and Laurian Van Maldeghem, in collaboration with researchers from Ghent University and European Open Science Cloud (EOSC-Life), as part of the **ASSEMBLE Plus** Networking Activity 2 (NA2): Improving Virtual Access Provision. The course is a response to the FAIR data-management challenges that participants of the **ASSEMBLE Plus** Transnational Access Programme seemed to find particularly challenging.

The main goal of the course is for participants to obtain a practical understanding of what 'FAIR data' means for a researcher and how to implement FAIR principles in their research. Prerequisites include a basic understanding of working with spreadsheets (e.g. Microsoft Excel) and to understand or have some experience producing experimental data. The course consists of five lessons:

1. What is FAIR and open data and why is it important;
2. How to format spreadsheet data to be interoperable and reusable;
3. Annotating data with controlled vocabularies;
4. Providing provenance for research data, and,
5. A FAIR checklist.

Each lesson is estimated to take approximately one hour and consists of written text to study followed by self-assessment questions and exercises, for which the answers are provided after completion.

The course is free but those interested in undertaking it must first register on the OceanTraining Platform. Learn more about the FAIR Data for Marine Biologists course.

If you are interested in learning more about data management within **ASSEMBLE Plus,** please visit the Data Management page or get in touch with Katrina Exter (VLIZ) at katrina.exter@vliz.be.

Event: ASSEMBLE Plus Conference 2022 | *by Adelino Canario (CCMAR, Portugal).*

The **ASSEMBLE Plus** Conference 2022, "Marine biological research at the frontier", was organised by the Algarve Centre of Marine Sciences (CCMAR), on behalf of the **ASSEMBLE Plus** project. The final conference of the project was held virtually over a two-week period from 13-24 June 2022.

The main objective of **ASSEMBLE Plus** has been to provide the scientific community (from academia and industry) with access to the resources, facilities, and instruments available at marine biological stations. With this purpose in mind, the conference had several aims:

1. To present the offerings and services available from **ASSEMBLE Plus** partners to potential users.
2. To showcase the projects and scientific achievements of hosted **ASSEMBLE Plus** users.
3. To collect feedback from stakeholders on improving the services offered and extending its reach to the scientific community, especially with industry partners.
4. To promote the project and the services offered by its partners.

It was a packed programme that included an enjoyable mix of presentations of the latest research by **ASSEMBLE Plus** partners and users, Q&A discussions, short videos giving insight into European marine stations and research infrastructures, service and technology demonstrations and B2B matchmaking events with industry as well as workshops. The project was honoured to have three keynote speakers, Detlev Arendt (European Molecular Biology Laboratory (EMBL), Germany); Melody Clark (British Antarctic Survey, UK) and Matthew Sullivan (Ohio State University, USA).

The conference had an audience of international marine biology stakeholders from industry, research, policy and potential investors as well as members of the public with an interest in marine biological research. The event was widely promoted amongst the scientific community via social media and press releases, leading to high levels of attendance (246 registered participants), with daily participation ranging from 100-150 people. Conference organisers were delighted to receive positive feedback from those who attended, as well as gratitude for the conference recording from those who were either unable to attend or missed parts due to different time zones around the world!

ASSEMBLE Plus and CCMAR would like to thank all of the speakers and participants for their valuable contribution to the sessions.
The programme from this conference is available on the event webpage and videos from the sessions will soon be made available on the EMBRC's YouTube channel.

If you are interested in contacting any of the conference's researchers, marine stations or research infrastructures, please get in touch with Adelino Canario (CCMAR) at acanario@ccmar.pt.

News Article: New approaches for aquaculture and mollusc research as study shows cryopreserved mussel larvae can survive and develop to adult mussels.

A long-term study funded by the ASSEMBLE Plus project has shown that adult mussels can grow from cryopreserved larvae without compromising the quality of the next generation's offspring, neither for cryopreservation nor post-thawing development of them.

The Mediterranean mussel *Mytilus galloprovincialis* is one of the most farmed molluscs worldwide. This is the first time *M. galloprovincialis* spat produced from cryopreserved larvae were able to develop into adults at the same growth rates as control individuals, be cultured in a natural environment, and even reach average commercial size at the same time as control mussels obtained from non-cryopreserved larvae. Additionally, the viability of the produced adults is apparently unaffected by the cryopreservation process, with fertility and offspring quality comparable with those of control mussels.

Dr Estefania Paredes, Universidade de Vigo (ECIMAT-UVIGO), who led the research team that designed the cryopreservation protocol said,

"Shellfish aquaculture needs the development of new tools such as this to reduce its reliance on natural spat collection whilst improving good practices and efficiently increasing production. The results signify strong evidence for the suitability of this cryopreservation method for use in mussel aquaculture and in research, where animals must be in optimal health."

Details of the cryopreservation protocol are published in the open access *Scientific Reports* (August 2022): Heres, P., Troncoso, J. and Paredes, E. (2022). Long-term study on survival and development of successive generations of *Mytilus galloprovincialis* cryopreserved larvae. *Scientific Reports* 12, 13632. https://doi.org/10.1038/s41598-022-17935-0.

Jesus Troncoso checking the mussels growing to adults in ropes after cryopreservation of the larvae. © Jesus Troncoso.

ASSEMBLE Plus's Joint Research Activity 2 (JRA2) Cryobanking Marine Organisms, addresses a constraint in the exploitation of marine genetic and biological resources, namely the current paucity of capability for preserving these resources ex-situ with guaranteed genetic, phenotypic and functional stability. JRA2 has developed reproducible cryopreservation methodologies for various life-stages of a range of marine macro-organisms and cryo-recalcitrant microorganisms. The results will improve and expand the availability of biological resources for Transnational Access at significantly reduced costs.

Juvenile mussels (from cryopreserved larvae) settled in ropes with their growth being checked. © Pablo Heres and Estefania Paredes.

Article: Ocean Sampling Day – Data now available! | *by Katrina Exter (VLIZ, Belgium) and Georgios Kotoulas (HCMR, Greece).*

Marine Biodiversity Observation Networks (MBON) are a growing global initiative consisting of regional networks of scientists, resource managers and end users, working to integrate data from existing long-term programmes. The aim is to improve our understanding of changes and connections between marine biodiversity and ecosystem functions. Within **ASSEMBLE Plus's** Joint Research Activity 1 (JRA1) there are two genomic observation networks: Ocean Sampling Day (OSD) and Autonomous Reef Monitoring Structures (ARMS-MBON).

OSD is a simultaneous worldwide research campaign where marine biologists around the globe participate in sampling of the world's oceans to produce contextual genomic data. OSD was launched by the MicroB3 project on the summer solstice, 21 June 2014, with **ASSEMBLE Plus** taking on the OSD coordination in 2018. Through MBONs collecting cumulative samples, related in time, space and environmental parameters, researchers can gain invaluable insights into the marine environment, including insights into the changes in biodiversity as a result of climate change and the introduction of non-native species by shipping, etc. DNA analysis with chosen marker genes allows us to identify all prokaryotic and eukaryotic microbial species in the water samples obtained, while analysis of metagenomic data allows us to assess the functional content and potential of bacterial communities.

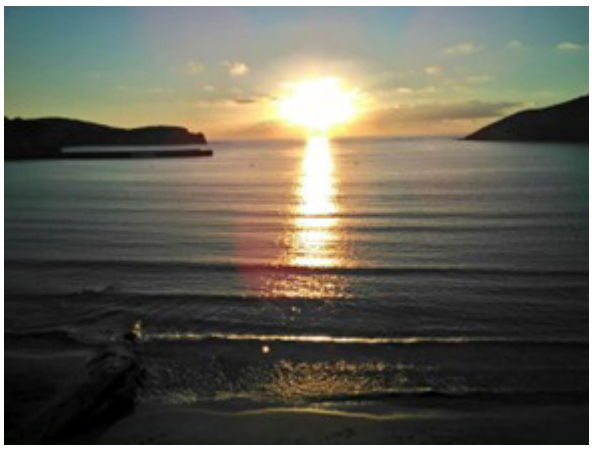
Among the many questions that the data can answer, the basic ones include "what organisms are found where" and "what functions they can fulfil, under the assessed environmental conditions". All the samplings were carried out in a standardised way to allow comparability among samples and an accurate tracking of changes in the marine environment over time. The data collected will be a reference set for generations of experiments to follow in the coming decades. One particular project that has benefitted from OSD data is the European Marine Omics Biodiversity Observation Network (EMO BON), an EMBRC project aiming to enhance the European contribution to global genomic observation efforts.

Since 2018, **ASSEMBLE Plus** partner, the Hellenic Centre for Marine Research (HCMR) in Heraklion, Crete, has coordinated OSD, received and processed all the samples as well as extracted the DNA and sequenced 16S and 18S rRNA. Shotgun metagenomics data have also been produced by GENOSCOPE, France.

An important effort was necessary to find the best ways to make the data open access and FAIR (Findable, Accessible, Interoperable and Reusable), this was achieved by collaboration between the Flanders Marine Institute (VLIZ), German Federation for Biological Data (GFBio) and HCMR. There is no one best route to data FAIRification, and there is still room for improvement in the interoperability between databases hosting biodiversity and environmental data and databases hosting molecular data. OSD data FAIRification has inspired collaborative projects between the European infrastructures European Marine Biological Resource Centre (EMBRC ERIC), ELIXIR Europe, and LifeWatch ERIC, within the context of the European Open Science Cloud (EOSC). The cost of sequencing has been covered by EMBRC. The value of FAIR data will increase with time, as any new environmental dataset can be compared to add insights on marine biodiversity structure, function and dynamics. As the quantity of genomic data on single species increases with time, and high quality genomic and biological annotations are added, OSD data can be revisited and reanalysed to deliver more knowledge.

HCMR has carried out a preliminary analysis on the DNA metabarcoding of the OSD 16S rRNA data, to gain insights into the value of the data. These analysis results (species identifications) and the raw sequence data are published, to be shared for exploration with experts around the world. The OSD 2018 and 2019 sampling, environmental, and raw sequence data are published as a metadata record via VLIZ's Integrated Marine Information System (IMIS); the OSD 2014 data have long been published on PANGAEA. Species identifications obtained from all three years of OSD will also shortly be submitted to biodiversity archives (OBIS, GBIF). The datasets and metadata are also available via the OSD GitHub Repository which also provides the data in machine-accessible formats, ensuring the data is in compliance with H2020's Open Research Data Pilot, following the principles of FAIR (Findable, Interoperable, Accessible and Reusable).

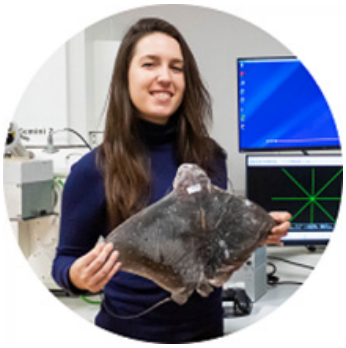
For any questions, information, or assistance, contact the OSD team by sending an email to osd-contact@embrc.eu. For more information, please visit the OSD webpage. You can also watch previous videos at the OSD YouTube channel. Research contact from the Hellenic Centre for Marine Research (HCMR): Georgios Kotoulas kotoulas@hcrm.gr.



*The Plentzia Marine Station of UPV/EHU; which is part of EMBRC and also runs the Spanish **ASSEMBLE Plus** partnership.*

Success Story: Skeletal growth mechanisms in elasmobranch fishes.

Júlia Chaumel and Mason Dean (Max Planck Institute of Colloids and Interfaces, Germany).
Access provider: Observatoire Océanologique de Banyuls sur Mer (OOB), France.



We applied to **ASSEMBLE Plus** to work with living rays (elasmobranchs) in the aquaria of Banyuls-Sur-Mer (OOB), in southern France.

We are marine biologists, using material characterisation and imaging techniques to study elasmobranch skeletons, which are made of cartilage, not bone. It is thought that the elasmobranch skeleton never stops growing and mineralisation is controlled to occur only in certain zones of the skeleton. To test this, we developed a longitudinal experiment to visualize regions of active mineral deposition, by injecting calcium markers in living animals and examining new tissue with fluorescent microscopy.

Such live animal work is impossible at our home institute; **ASSEMBLE Plus** helped us to collaborate with a seaside institution with aquarium facilities, essential to study living marine animals. This opportunity allowed us to grow personally and scientifically, sharing knowledge and learning from different fields, and establishing fruitful collaborations abroad, important points for diverse and interdisciplinary career development.

Success Story: Structure and rates of energy fluxes in the plankton assemblages of the Gullmar fjord.

Danilo Calliari (Universidad de la Republica, Uruguay).
Access provider: Kristineberg Marine Research Station (KMRIC), Sweden.

The mechanisms that modulate the fluxes of energy and organic matter in the marine pelagic ecosystem constitute one central topic of interest in our investigations. The microzooplankton is a ubiquitous group of (mostly) unicellular protozoans which are thought to constitute the main grazers of marine primary production. Those are also very delicate organisms, and experimental research on their ecology requires carefully controlled conditions.

We applied to **ASSEMBLE Plus** in order to access laboratories and equipment at Kristineberg Marine Research Station (KMRIC) where infrastructure for experimental research on marine organisms and ecosystems is ideal. For one month, we developed a series of experiments which provided clear evidence on density-dependent grazing rates by the natural microzooplankton community of the Gullmar Fjord.

It was an overall great experience, where we managed to obtain valuable results in a short time under a very pleasant working environment.

Outcomes of the research activity performed within the Transnational Access are open access and have already been published in the ASSEMBLE Plus Open Repository here!

Success Story: *Spondylus* multiomics: bridging biomineralization and archaeology.

Jorune Sakalauskaite (University of Torino, Italy).
Access provider: Hellenic Centre for Marine Research (HCMR-IMBBC), Greece.

I applied to the **ASSEMBLE Plus** programme because I was searching for a way to collect live specimens of *Spondylus gaederopus* molluscs and to obtain their genomics data.

My research focuses on studying mollusc shell proteins which are inside the mineral skeleton for dual purposes: to better understand the molecular aspects of biomineralisation and also to use them as molecular barcodes to identify the biological origin of prehistoric shell artifacts. *Spondylus* is particularly interesting because it was one of the most widely used Mediterranean shells in European prehistory, reshaped and worked into elaborate jewels.

The data obtained via **ASSEMBLE Plus** will enable me to have a full identification of *Spondylus* proteome and use it in future projects.

Thanks to **ASSEMBLE Plus** I was able to access marine resources and molecular biology labs simultaneously. More importantly, it was an incredible experience to work in a highly stimulating environment and the HCMR staff were extremely helpful. The work had a great impact in shaping my PhD research and will likely end up with future collaborations.

Success Story: Assessment of the effect of microplastics in Mediterranean mussel (*Mytilus galloprovincialis*) in Northern Adriatic.

Stoimir Kolarevic (University of Belgrade, Serbia).
Access provider: National Institute of Biology (NIB), Slovenia.

I applied for Transnational Access (TA) in the Marine Biology Station in Piran together with my colleague Dr Margareta Kračun-Kolarevićć

We were interested in moving the knowledge gained in freshwater ecosystem research to marine ecosystems. The major objective of our project was studying the effects of microplastics and adsorbed pollutants on Mediterranean mussel (*Mytilus galloprovincialis*) as a sentinel species. The effect was measured under ecological relevant scenario for the Northern Adriatic, simulated in the controlled experimental conditions. We focused on DNA damage as an endpoint of specific interest in indicated scenario.

Research started within the TA was a milestone for further cooperation. Currently our institutions are preparing joint projects within the call for the projects for bilateral cooperation between Serbia and Slovenia.

Visiting the Marine Biology Station in Piran was an outstanding experience. We had wonderful hosts in the Station providing everything we needed for high quality research. We would strongly recommend the Marine Biology Station to future TA users.

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ABOUT THE PROJECT

THE CHALLENGE

Researchers from academia and the private sector need high-quality access to sophisticated marine biological research infrastructures to conduct their research for the advancement of knowledge and technology, to inform policy and to contribute to blue growth.

PROJECT OBJECTIVE

Building on the success of its predecessor ASSEMBLE (2009-2014), the EU-funded **ASSEMBLE Plus** brings together key marine biological research institutes across Europe and overseas to ensure their optimal use and joint development. In particular, **ASSEMBLE Plus** provides expenses-paid Transnational Access to the ecosystems, marine organisms, and facilities available at its partner institutes.

AT A GLANCE

PROGRAMME: Horizon 2020 (INFRAIA-01-2016-2017)

TYPE OF ACTION: Research and Innovation Action

DURATION: Oct 2017 – Sept 2022 (60 months)

CONSORTIUM: 26 partners from 16 countries

COORDINATOR: Sorbonne Université (SU), France

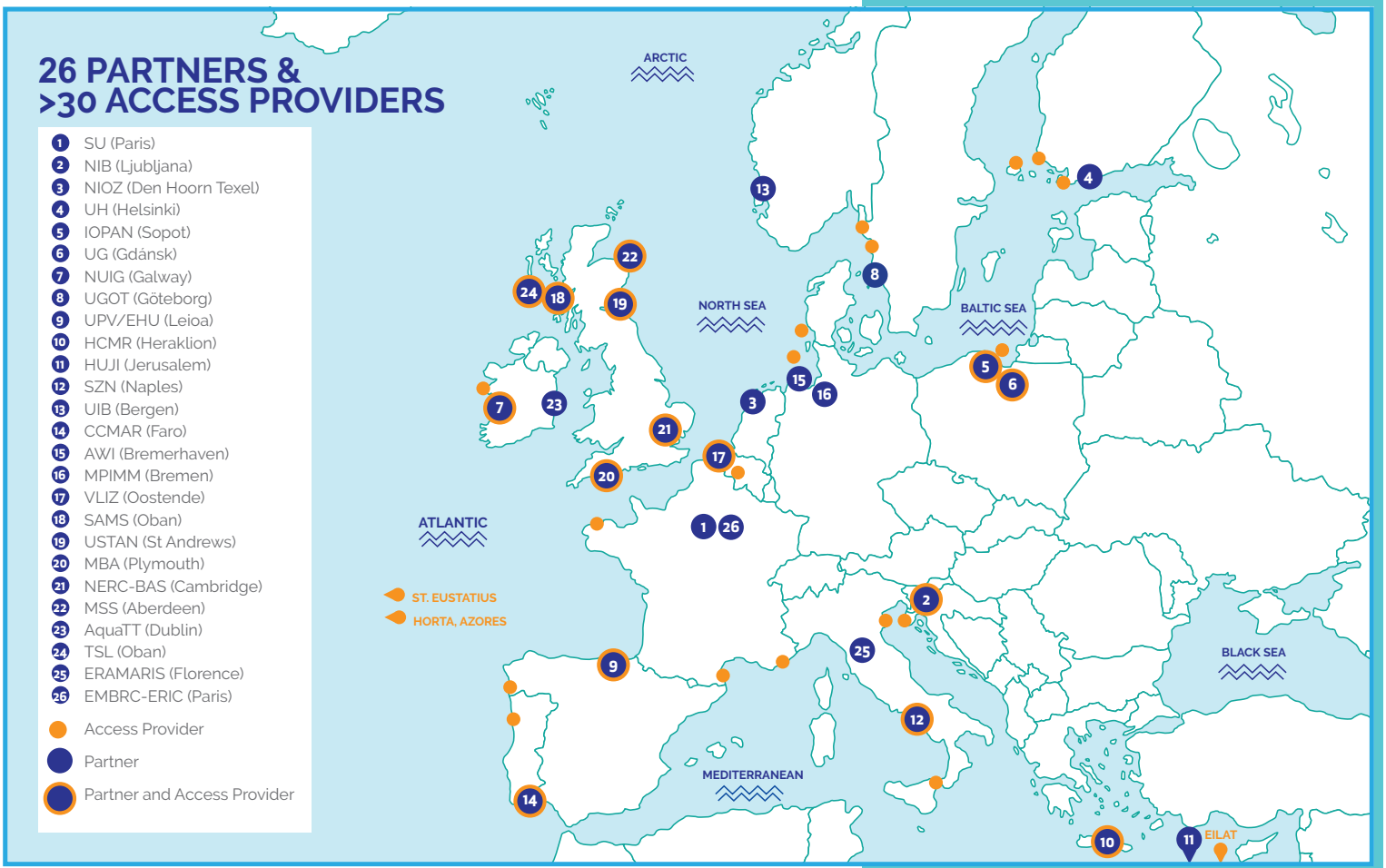
26 PARTNERS & >30 ACCESS PROVIDERS

1. SU (Paris)
2. NIB (Ljubljana)
3. NIOZ (Den Hoorn Texel)
4. UH (Helsinki)
5. IOPAN (Sopot)
6. UG (Gdańsk)
7. NUIG (Galway)
8. UGOT (Göteborg)
9. UPV/EHU (Leioa)
10. HCMR (Heraklion)
11. HUJI (Jerusalem)
12. SZN (Naples)
13. UIB (Bergen)
14. CCMAR (Faro)
15. AWI (Bremerhaven)
16. MPIMM (Bremen)
17. VLIZ (Oostende)
18. SAMS (Oban)
19. USTAN (St Andrews)
20. MBA (Plymouth)
21. NERC-BAS (Cambridge)
22. MSS (Aberdeen)
23. AquaTT (Dublin)
24. TSL (Oban)
25. ERAMARIS (Florence)
26. EMBRC-ERIC (Paris)

Access Provider

Partner

Partner and Access Provider



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