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1 Introduction

Work Package 2 Transnational Access (TA) is the core activity of the Eurofleets+ project dedicated to providing TA to researchers from academia and industry. It focused on providing transnational access to twenty seven Research Vessels (RV), seven Remotely Operated Vehicles (ROVs) and five Autonomous Underwater Vehicles(AUVs). An additional ROV (HCMR's Max Rover) was included via a project amendment in order to implement the ERODOTO proposal as no suitable alternative was available. Access was organised in three access programmes;

1. **Ship-time and Marine Equipment Application (SEA programme)** in two dedicated calls; the Oceans Call which focused on Ocean going research vessels and equipment and the Regional Call focusing mainly on smaller regional vessels.
2. **Co-PI Programme** – a running call aimed at early career researchers to implement their own research together with experienced scientists on Eurofleets+ scheduled cruises.
3. **Remote Transnational Access (RTA programme)** to provide researchers with access to samples or data from a Eurofleets+ vessel.

This deliverable describes the transnational access projects implemented under the three access programmes in Eurofleets+. A total of twenty-eight (28) TA projects were implemented (**twenty-three** SEA cruises, **four** Co-PI projects and **one** RTA project). A full detailed cruise report is available on the Eurofleets+ website on the relevant cruise page

<https://www.eurofleets.eu/access/scheduled-transnational-access-cruises/>

An overview of the datasets arising from the research cruises and where they can be accessed is available in Eurofleets+ deliverables D9.15 and D4.12.

2 Transnational Access Calls Results

The projects implemented in each of the three access programmes and the statistics pertaining to each are described below, a summary of the applications received for each call are outlined in Deliverable 4.14 *Report on Cruise Implementation*. The Eurofleets+ Infrastructure used to achieve the TA is outlined in Table 1 below:

Infrastructure Name	Infrastructure Type	Infrastructure Operator	Country of Origin	TA Project Implemented
UGOT's AUV 'RAN'	Autonomous Underwater Vehicle	University of Gothenburg	Sweden	FOCUS-AUV
RV Celtic Explorer	Research Vessel	Marine Institute	Ireland	PORO-CLIM
RV Pelagia	Research Vessel	NIOZ	Netherlands	iMAR, CALYPSO, OASIS
RV Dana	Research Vessel	DTU	Denmark	GSHARK
RV GO Sars	Research Vessel	IMR	Norway	BENCHMARK
ROV Aegir	Remotely Operated Vehicle	IMR	Norway	BENCHMARK
RV Tubitak Marmara	Research Vessel	Tubitak Marmara	Turkey	PHYCOB
RV SOCIB	Research Vessel	SOCIB	Spain	GRASSMAP
RV Aegaeo	Research Vessel	HCMR	Greece	MYRTOON, ERODOTO
RV Aranda	Research Vessel	SYKE	Finland	CABLE
RV Belgica	Research Vessel	RBINS	Belgium	GRACE, SEAQUAKE, TalPro2022, IsoMed (RTA)
AUV Barabas	Autonomous Underwater Vehicle	VLIZ	Belgium	GRACE, SEAQUAKE, ERODOTO
RV Arni Friedrikson	Research Vessel	MFRI	Iceland	SENERGY
RV Sanna	Research Vessel	GINR	Greenland	IOPD, GLICE
RV Atlantic Explorer	Research Vessel	BIOS	Bermuda	FIGURE, CARING
RV Ramon Margalef	Research Vessel	CSIC	Spain	CARBO-ACID
RV Sarmiento de Gamboa	Research Vessel	CSIC	Spain	SINES
RV Tangaroa	Research Vessel	NIWA	New Zealand	HYDEE-OBS, VISIT
ROV Max Rover	Remotely Operated Vehicle	HCMR	Greece	OASIS, UNSEEN, ERODOTO
RV Laura Bassi	Research Vessel	OGS	Italy	POSEIDON

Table 1 Eurofleets Infrastructures Used to Implement Transnational Access(TA)

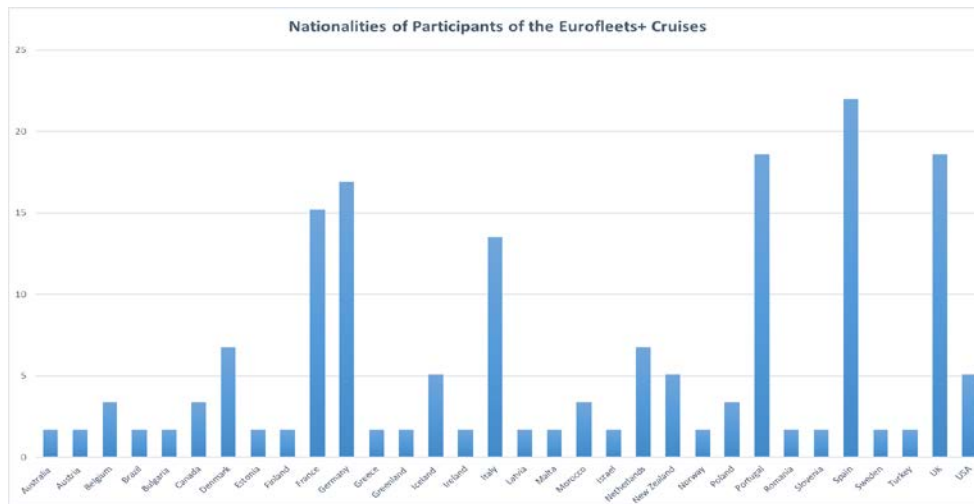


Figure 1 Nationalities of TA Cruise Participants

All cruises had participants from at least two nationalities taking part although many had up to three and four different nationalities participating representing 33 different nationalities in total.

The main scientific disciplines of funded TA cruises were Geology, followed by Biological Oceanography, Biogeochemistry and Climate Dynamics.

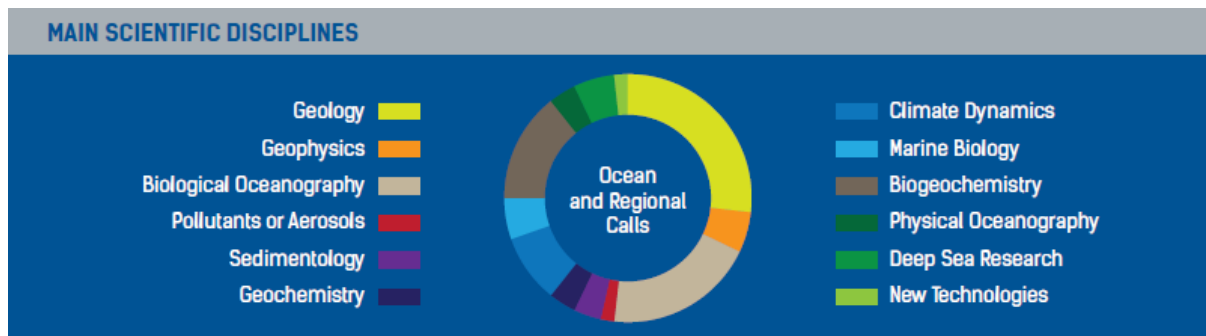


Figure 2 Main Scientific Disciplines of Funded Transnational Access

Although the majority of the Principle Investigators were Male (17 Male, 6 Female), the gender of cruise participants was fairly balanced. Out of a total of 291 cruise participants, 135 were Female and 156 Male. 66 of the 111 early career Cruise participants were Female and 45 Male.

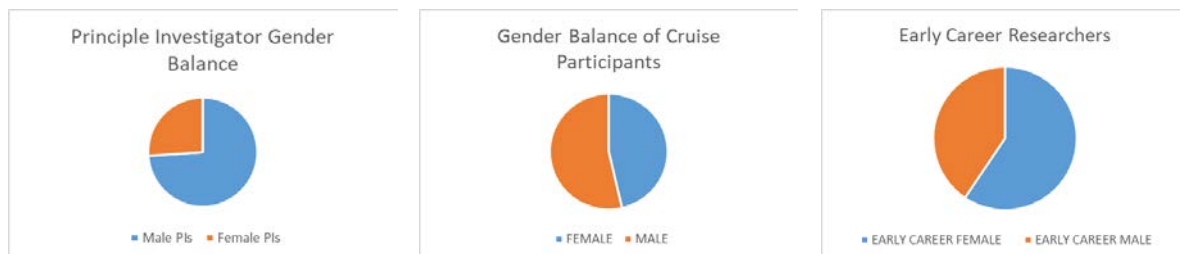


Figure 3 Gender Balance of Cruise PIs and Participants

2.1 Oceans Call Implemented Cruises

Thirteen cruises were implemented out of the 34 proposals received in response to the Oceans Call. This call enabled researchers to apply for mainly large ocean-going research vessels and marine equipment. A summary of each cruise's activities is provided in this section.

Cruise Name	No. of Days	Vessel/ Marine Equipment	Discipline	Lead Organisation	Location	Region
Focus-AUV	29	UGOT's AUV RAN	Geology, Marine Biology, Sedimentology	NIWA	Kaikōura Canyon, New Zealand	Pacific Southern Ocean
PORO-CLIM	13	RV Celtic Explorer	Climate dynamics, Geophysics, Sedimentology, Training	Birmingham University, UK	NE Atlantic (S Rockall Plateau)	North Atlantic
iMAR	17	RV Pelagia	Biological Oceanography, Geology, New technologies	University of the Azores, Portugal	Mid-Atlantic Ridge	North Atlantic
GSHARK	7	RV Dana	Marine Biology	University of Massachusetts, USA	Bredefjord, Greenland	North Atlantic
BENCHMARK	10	RV GO Sars _ROV Aegir	Marine Biology Physical Oceanography	Marine and Freshwater Research Institute, Iceland	Denmark Strait	North Atlantic
CALYPSO	17	RV Pelagia	Physical Oceanography	University of California, USA	Alboran Sea	Mediterranean
TAIPro2022	10	RV Belgica	Physical Oceanography	Italian National Research Council	Algero-Provencal Basin, Sicily Channel, Tyrrhenian Sea, Ligurian Sea	Mediterranean
SENERGY	8	RV Arni Friedrikson	Marine Biology	Bangor University, UK	North Western Iceland	North Atlantic
IOPD	12	RV Sanna	Biogeochemistry, Climate dynamics, New technologies,	VLIZ, Belgium	Nuuk, Greenland	North Atlantic

			Marine/Polar Biology, Training			
GLICE	14	RV Sanna	Biological Oceanography, Biogeochemistr y, Physical Oceanography	GEOMAR, Germany	Disco Bay, West Greenland	North Atlantic
VISIT	12	RV Tangaroa	Geophysics	Imperial College, UK	East coast of North Island, New Zealand	Pacific Southern Ocean
HYDEE-OBS	8	RV Tangaroa	Geophysics	Geomar, Germany	Hikurangi Margin, North Island, New Zealand	Pacific Southern Ocean
OASIS	12	RV Pelagia	Geology, New technologies, Marine Biology, Physical Oceanography	CSIC, Spain	SE Alboran Sea (W Mediterranean)	Mediterranea n

Table 2 Ocean Call Cruises' Summary

Most Oceans Call cruises took place in the North Atlantic, followed by the Pacific Southern Ocean and the Mediterranean.

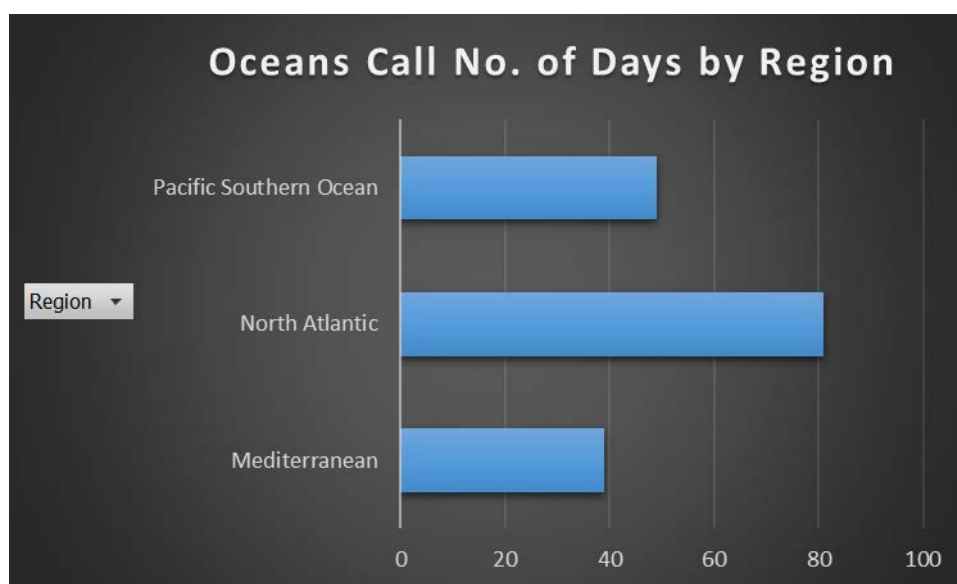


Figure 4 Oceans Call Cruise Regions

	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
Focus-AUV	Fine Scale Observations following earthquake-triggered Canyon flUShing by AUV survey	University of Gothenburg's AUV Ran	September 30 - October 29 2020	Dr Joshu Mountjoy	National Institute of Water and Atmospheric Research (NIWA)	New Zealand

The **FOCUS-AUV** Cruise took place on board the National Institute of Water and Atmospheric Research's (NIWA) RV Tangaroa with the University of Gothenburg's Hugin AUV Ran. It was the first Eurofleets+ cruise and the only one that was implemented in 2020 due to Covid-19. The AUV was used to survey the Kaikōura canyon, off the east coast of the South Island in New Zealand, to measure the ecological and sedimentological impact and recovery following the 2016 Kaikōura Earthquake.

Following the earthquake in 2016 two NIWA surveys discovered large areas of the Kaikōura Canyon had drastically changed. An enormous amount of mud and sediment – estimated to be about 850 million metric tonnes – was shaken off the canyon rim and then flowed down into the canyon channel causing a powerful “flushing” of sediment out to the deep ocean.

The principle aim of the cruise and use of the AUV was to understand the physical process that has removed such a huge amount of sediment and rock from the canyon. This flushing immediately turned the canyon from a biodiversity hotspot full of dense populations of large invertebrates and abundant fish species into a barren, almost uninhabited landscape.

A total of 14 dives were completed out of 17 planned dives. The survey areas had to be modified to allow for weather conditions, however the final overall operations and survey coverage are considered highly successful.

Visit the FOCUS-AUV cruise page [here](#) for more information and to view a project video.



Figure 5 Images from the Focus-AUV cruise

PORO-CLIM	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Deep Structure of PO rcupine and RO ckall Margins: Did the North Atlantic Igneous Province alone cause the Paleocene/Eocene Thermal Maximum?	RV Celtic Explorer	07 - 30 May 2021	Dr Stephen Jones	University of Birmingham	UK

Project **PORO-CLIM** studied the interaction between the geological processes of continental rifting and break-up, Large Igneous Province emplacement, and global climate change. Cruise CE21008, the PORO-CLIM data acquisition cruise, carried out a marine geophysical survey of the Porcupine and ROckall continental passive margins, to investigate the cause of the Paleocene/Eocene Thermal Maximum, a natural CLIMate change event that is the closest deep-time analogue of anthropogenic environmental change (though the modern change is happening much faster). Project PORO-CLIM also includes a three-year post-cruise data work-up phase.

Despite the Covid-19 pandemic and resulting travel restrictions at the time, cruise CE21008 went ahead with a reduced science party of 13 including about half the planned compliment of early career researchers.

Two deep seismic profiles were acquired, which were the first and third profiles on the initial priority list. 47 ocean bottom seismometers (OBS) were deployed with instrument spacings of 10 to 15 km. Seismic reflections were recorded on a 1 km long multi-channel streamer (MCS) towed behind the vessel. A magnetometer was towed behind the vessel alongside the MCS in order to determine oceanic crustal age. 65 expendable bathythermograph (XBT) probes were deployed to constrain the seismic velocity in the water layer. These datasets will be integrated post-cruise to give full crustal velocity models which will allow crustal structure and in particular crustal thickness to be interpreted. Initial data processing carried out onboard indicates that the dataset is of good quality and can address all scientific aims.

Further information is available on the project's website and cruise blog which can be accessed [here](#).

Three posters were created to promote Poro-Clim activities and can be viewed below:

<https://www.eurofleets.eu/wp-content/uploads/2023/09/Slide1-1.png>

<https://www.eurofleets.eu/wp-content/uploads/2023/09/Slide2-1.png>

<https://www.eurofleets.eu/wp-content/uploads/2023/09/Slide3-1.png>

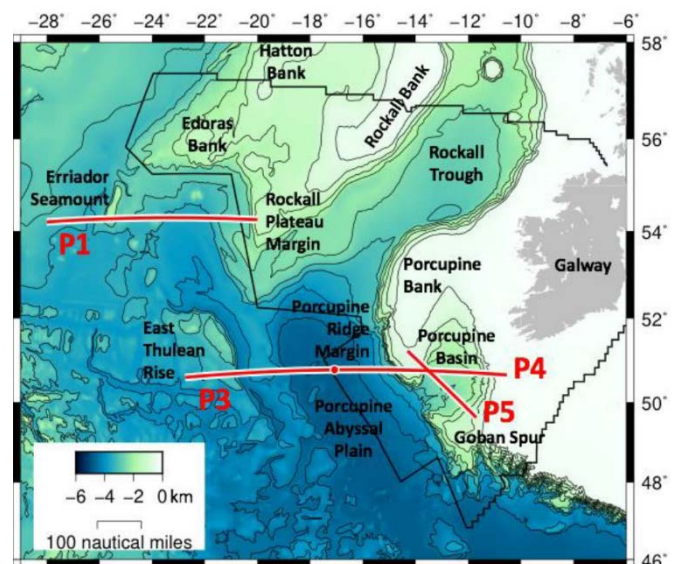


Figure 6 PORO-CLIM Work Area

iMAR	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	iMAR - Integrated assessment of the distribution of Vulnerable Marine Ecosystem along the Mid-Atlantic Ridge in the Azores	RV Pelagia	May 18 - June 3 2021	Telmo Morato,	University of the Azores, Portugal	Portugal

The main aim of the iMAR cruise was to evaluate the role of the Mid Atlantic Ridge in shaping the latitudinal and longitudinal patterns in deep-sea benthic biodiversity. In particular, iMAR aimed to (i) map and characterize deep-sea coral and sponge communities inhabiting unexplored seamounts and ridges in the MAR; (ii) identify new areas that fit the FAO's Vulnerable Marine Ecosystem (VME) criteria; (iii) to contribute to the understanding of the environmental drivers that determine the spatial distribution of deep-sea benthic biodiversity in the MAR; and (iv) determine the condition of benthic communities by looking at evidence of fishing damage to fauna, presence of lost fishing lines and marine litter.



Figure 7 iMAR Science Team

The main activities during the iMAR cruise involved collecting multibeam data, CTD measurements, water and sediment samples, and tow camera transects to survey deep-sea coral and sponge communities. Water samples will be used for biodiversity analyses through eDNA methods and the characterization of water masses properties (nutrients and physical-chemical parameters). Sediment samples (collected at 1,000 m depth) will be used for biodiversity analyses through faunal studies and eDNA methods, microplastics, granulometry analyses, and physical-chemical studies.

Although the data has yet to be analysed in detail, the iMAR expedition identified new areas that fit the definition of Vulnerable Marine Ecosystems and compiled valuable scientific information to inform the development of policies that promote the preservation of the natural heritage, ensuring the sustainable use of the deep sea, minimizing negative impacts on these vulnerable ecosystems.

The video work that aimed to characterize the benthic communities revealed the largest aggregation of black corals (or black coral gardens) ever seen in the Azores and perhaps across the Atlantic. These corals are very slow growing and can live for several thousands of years and, therefore, the gardens that form can be considered as the equivalent of the redwood forests (oldest trees on the planet) that still persist, for example, in the United States of America. Several areas were also discovered with formations of deep-sea coral thickets that have an important role as carbon reservoirs and in mitigating climate change.

The iMAR Cruise Webpage is available at this [link](#).



Figure 8 ROV Still Images from iMAR cruise

GSHARK	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Old, cold, and slow, the ecology of Greenland sharks	RV Dana	July 30 - 12 August 2021	Dr Diego Bernal	University of Massachusetts Dartmouth	USA

Overall, the size, age, and population genetic structure of Greenland sharks in the North Atlantic and Arctic is unknown. Taken together, the unique life-history of Greenland sharks combined with a general lack of knowledge on their movement ecology and population status has led them to be classified as “Near threatened” by the International Union for the Conservation of Nature (IUCN, 2017), hence making this research cruise on the species very timely. The GSHARK cruise’s main aim was to carry out a number of projects related to Greenland shark biology to increase understanding of ageing, migration patterns, swimming behaviour, population genetics, reproductive biology, among others.



Figure 9 GHARK Survey Area

A scientific team of 12 researchers from the United States, United Kingdom, France, Sweden, and Denmark participated in this research cruise. During the cruise, shark specimens were collected using demersal longline gear, precise measurements were obtained, and tags attached. The sharks’ actual reproductive status was also determined (e.g., presence of oocytes, fertilized eggs, pups) via a portable Ibex Evo ultrasound machine. Blood samples were collected for subsequent analysis of reproductive hormone levels in order to determine the state of sexual maturity of each individual.

Scientists were successful in achieving most of what they set out to do on this cruise. While the catch data will provide a small window into the migratory patterns (capture location) of the sharks, the morphometric information may allow scientists to determine if Greenland sharks have any size or sex dependent spatial segregation. Any future recapture of a tagged shark will also provide invaluable data on their movement patterns and potential growth rate.

Further information on the project is available [here](#).

BENCHMARK	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Benthic Habitats in Denmark Strait	G.O. Sars & ROV Ægir 6000	August 1-10, 2021	Dr Julian M. Burgos,	Marine & Freshwater Research Institute	Iceland

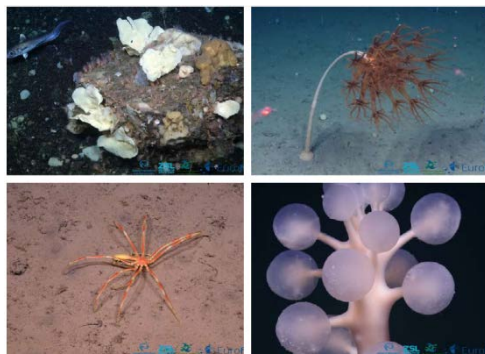


Figure 10 ROV images taken during BENCHMARK cruise

The objective of this cruise was to increase the knowledge of benthic habitats on the Denmark Strait and the Greenland-Iceland Rise (GIR), focusing on Vulnerable Marine Ecosystems (VMEs). The environmental gradients in Denmark Strait are among the strongest in the northern hemisphere. The high variability in depth, near-bottom temperature, salinity and current speed, it is likely to have a great influence in the distribution of benthic fauna, including in species that are considered VME indicators. Although information from different sources indicate that there is a high diversity of benthic habitats in this area, there are few direct observations, in particular in the deeper areas of the Icelandic EEZ and within Greenland

waters. With this cruise a baseline data will be obtained to characterise seabed habitats in this area.

Underwater video and photographs were collected using the ROV Ægir to characterise the composition and distribution of epibenthic fauna in the Denmark Strait, with a particular focus on taxa considered indicators of VMEs. The aim was to carry out ROV (Remotely Operated Vehicle) dives in 20 stations located along three transects running in a NW-SE direction across the Denmark Strait. Thanks to the professionalism of the vessel crew and the ROV operators, and aided by excellent weather conditions, all the cruise objectives were fulfilled and a rich set of observations were compiled which will be analyzed post cruise. Preliminary results show a very diverse habitat of sponges and cold-water corals in the area.



Figure 11 Benchmark Onboard Team

More information on Benchmark can be accessed on the Eurofleets+ [Webpage](#) including a video of a live ship-to-shore broadcast during one of the ROV dives. <https://www.zsl.org/news-and-events/feature/expedition-to-the-deep>

CALYPSO	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Coherent Lagrangian Pathways from the Surface Ocean to Interior	RV Pelagia	20 Feb - 12 March 2022	Dr Shaun Johnson	University of California, San Diego	USA

This is the third cruise for the US Office of Naval Research’s Coherent Lagrangian Pathways from the Surface Ocean to Interior (Calypso) project. The program is motivated by the understanding that the vertical movement of water from the surface to depth across the base of the mixed layer has implications for the transport of properties, gases, biogeochemistry, and the fate of drifting particles/objects. However, vertical velocities are weak (about a thousand times smaller than horizontal velocities) and difficult to detect. To represent these motions, the following questions need to be answered:

- How are water and properties from the surface boundary layer exported to depth?
- What coherent pathways act as conduits for exchange?
- What dynamics shapes these pathways? What are the Lagrangian trajectories, what are the time and space scales of subduction and where does the water end up?
- Can we predict these pathways in 3-Dimensions and what data are needed to aid or constrain predictive models?

Due to the need to sample across a range of scales, a two-ship study utilising the RV *Pelagia* along with the French RV *Pourquois Pas* and numerous autonomous and Lagrangian platforms was conducted. During the cruise, most of the operations from RV *Pelagia* focussed on repeat surveys at a front and a cyclonic eddy to the NE of the front with a variety of ship-based measurements and autonomous platforms. Two-ship operations combined repeat small-scale surveys by RV *Pelagia*, which were embedded within larger scale surveys by RV *Pourquois Pas*. Drifters were released sporadically to identify eddies and areas of possible convergence at fronts, where subduction may occur.

Further Information on Calypso is available [here](#).

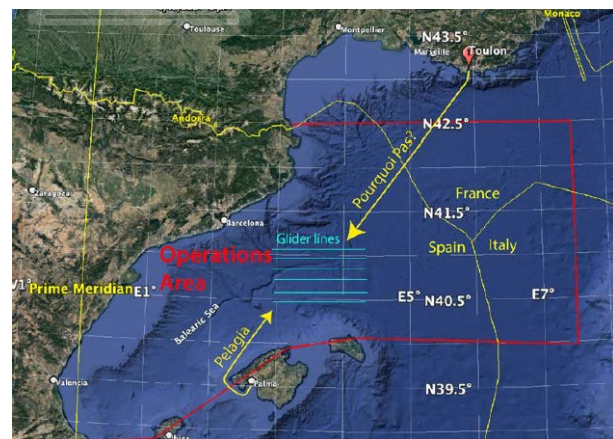


Figure 12 Calypso Area of Operation

TalPro2022	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	The Tyrrhenian Sea & Algero-Provencal component of the Med-SHIP programme	RV Belgica	17-26 May 2022	Dr Katrin Schroeder	CNR - Istituto di Scienze Marine (ISMAR)	ITALY

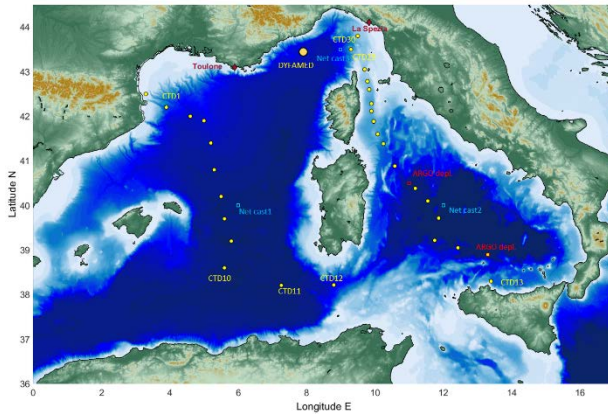


Figure 13 TAIPro2022 Stations

The last few decades have seen dramatic changes in the hydrography and biogeochemistry of the Mediterranean Sea. The complex bathymetry, the highly variable spatial and temporal scales of atmospheric forcing and internal processes contribute to generate complex and unsteady circulation patterns and significant variability in biogeochemical systems. Part of this variability can be influenced by anthropogenic contributions. Consequently, there is a need to document its details as well as to understand ongoing trends in order to better relate the observed processes and to possibly predict the consequences of these changes. The main goal of the cruise was to contribute to the understanding of long-term

changes and trends in physical and biogeochemical parameters, such as the anthropogenic carbon uptake and to still evaluate the hydrographical situation after the major climatological shifts in the western part of the basin, known as the Western Mediterranean Transition.

During the cruise, multidisciplinary measurements were conducted on 2 meridional sections between the northern and the southern Mediterranean shores, contributing to the global repeat hydrography program GO-SHIP and adhering to the GO-SHIP requirements. First CTD



Figure 14 TAIPro2022 Science Team

and tracer analysis suggest that the Tyrrhenian seems much more ventilated (compared to 2016 data). The basin is filling up with SF6, which might be an indication of increased ventilation (the link here is not yet clear). Last intense convection but not bottom reaching in the Gulf of Lion was reported in 2018. In the deep Algero-Provencal basin the shape of the TS-diagram has returned to what could be observed before the Western Mediterranean Transition (WMT), but with generally higher heat and salt contents.

TalPro2022 Cruise Page can be accessed [here](#) and poster [here](#).

SENERGY	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Using energy landscapes to explain habitat-use of seabirds	RV Arni Friedrikson	18 - 25 June 2022	Dr James Waggitt	Bangor University	UK

The SYNERGY cruise aimed to increase our understanding of mechanistic links between hydrology, prey characteristics and foraging decisions of seabirds. In particular, SYNERGY aimed to better understand which 3D prey characteristics influence foraging seabirds, and how oceanography influences these prey characteristics. For example, SYNERGY is keen to investigate the relative influence of prey exploitability (school density, dimensions, prevalence), quality (size, energetic content) and accessibility (distance from breeding colonies, depth) in foraging decisions, and whether trade-offs occur amongst characteristics.

The research vessel and study location is ideal for investigating these questions. Firstly, concurrent/simultaneous information on hydrology, prey and seabirds are needed for these investigations. The RV Arni Fredriksson is equipped with modern echosounders, several trawls, and CTDs. Second, NW Iceland supports dense populations of Alcidae during summer months, particularly Brunnich guillemot *Uria lomvia* and common guillemot *Uria aalge*. By investigating the relative importance of energetic costs (prey accessibility) and gains (prey exploitability and quality) in foraging decisions, and linking these foraging decisions to hydrology, the project provides insights into animal responses to environmental change.



Figure 15 The SYNERGY Scientific Team

Five transects of 60km length were completed, with each transect being replicated twice. An additional transect of ~ 40km length was performed in Arnarfjordur, because of its importance for Brunnichs Guillemot. During transects, 2 observers recorded the 2D foraging distribution of all seabirds using European Seabird At-Sea (ESAS) methodology. At the same

time, a scientific echosounder (Simrad EK80) operating at 5 frequencies (18, 38, 70, 120, 200 Khz) recorded the 3D distribution of fish and plankton. 22 trawls (plankton, midwater and demersal) were performed in response to fish and plankton detected in the scientific echosounder, providing insights into the species and size composition of these targets. 107 CTDs were performed at intervals along transects to measure 3D gradients in water column temperature, salinity, fluorescence and turbidity. In addition to the data collected by SYNERGY, 8 Brunnichs and 6 common guillemots from the breeding colony at Látrabjarg were simultaneously equipped with GPS loggers and/or Time-Depth-Recorders (TDRs) by collaborators from the British Antarctic Survey (BAS). For more information go to the [SENERGY Webpage](#).

IOPD	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Innovative study on regional high resolution imaging of glacier induced Plankton Dynamics in West-Greenland fjords	RV Sanna	28 June - 10 July 2022	Dr Wieter Boone	Flanders Marine Institute	Belgium

The West Greenland marine ecosystem forms a complex interaction between the marine areas along the West Greenland banks and the numerous fjords that drain meltwater from the Greenland Ice Sheet to the ocean. Marine ecosystem productivity is very differently regulated in fjords influenced by either land- or marine-terminating glaciers. Rising subsurface meltwater plumes originating from marine-terminating glaciers entrain large volumes of ambient deep water towards the surface. The resulting upwelling of nutrient-rich deep water sustains a high phytoplankton productivity throughout summer in the fjord with marine-terminating glaciers. In contrast, fjords with only land-terminating glaciers lack this upwelling mechanism, and are characterized by lower productivity (Meire et al., 2017). Due to the melting of the Greenland Ice Sheet, the fjords will shift to systems with more land- instead of marine-terminating glaciers. By sampling these two types of fjords, the consequences of climate change on the plankton community and marine ecosystem can be researched.

During the IOPD cruise, a multidisciplinary team of marine biologists, physical oceanographers and engineers went to the Uummannaq region to study the plankton and nutrient dynamics of West Greenland fjords and their oceanographic drivers. The good weather allowed the team to make optimal use of the ship's time and in total five fjords and the connecting shelf area were sampled. The team of early career researchers sailed from the shelf edge towards the head of the fjord or until icebergs blocked the way. To achieve their goal proven oceanographic equipment was used such as conductivity- temperature-depth profilers (Sea-Bird Scientific, RBR, Sea & Sun Technology), microstructure profilers (Rockland Scientific Inc.), plankton nets (Apstein, MultiNet and MIK net), Niskin bottles for water samples, and more. In addition, they made use of emerging technologies such as a Fast Repetition Rate Fluorimeters (FastOcean), as well as towed and profiling plankton imaging sensors including a Video Plankton Recorder (VPR, towed system, SEASCAN INC) and a CPICS (CoastalVision) to get high spatial resolution images of the plankton community composition.

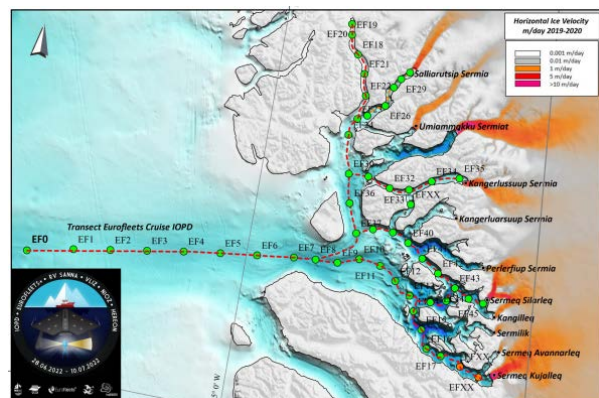


Figure 16 IOPD Cruise Transects Map

More information is available on the IOPD cruise page [here](#).

GLICE	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Greenland's Icebergs and their biogeochemical impacts	RV Sanna	10 - 24 August 2022	Dr Mark Hopwood	Geomar Helmholtz Centre for Ocean Research Kiel, Germany/ SUSTech Southern University of Science and Technology, China	Germany

This research program investigated the role of icebergs in the marine system focusing on coastal dynamics around one of the largest glaciers in the world, Jakobshavn Isbræ. Specifically, (a) how iceberg melt affects the structure of the water column, (b) how iceberg age affects the chemical composition of ice, for example from the rapid loss of basal/sediment-rich ice and on-going photochemical processes and (c) how melt water from glaciers affects pelagic primary producers. Underway sensors were utilised to show, in high resolution, the fate of runoff from Greenland and a series of incubation experiments and water column profiles to assess the effects of melt water on primary producers and the marine carbon cycle.

GLICE embarked a team of scientists to study the effect of icebergs on pelagic processes in Disko Bay in August 2022, anticipated to be close to the peak of the annual melt season. A combination of underway measurements, profiles and opportunistic sampling around icebergs were used to increase understanding of how ice melt affects marine biogeochemistry. In addition to sensor-based salinity, temperature, chlorophyll and turbidity measurements, our team focused on carbonate chemistry (direct measurements of $p\text{CO}_2$, pH and total alkalinity, TA), macronutrients (nitrate, phosphate, silicic acid – with a subset of samples analysed for silicic acid at sea) and acoustic Doppler current profiler (ADCP) data acquisition.

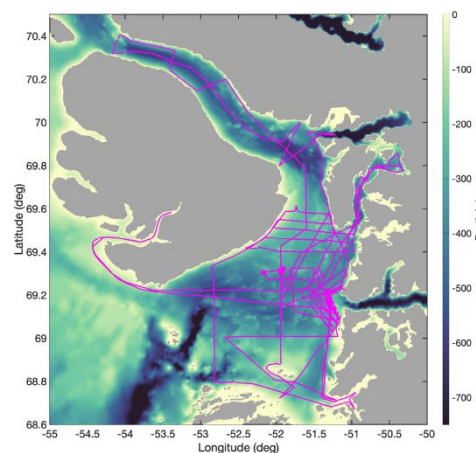


Figure 17 GLICE Cruise Track

Sampling focused mainly on the upper 100 m where the strongest gradients in parameters that may respond directly to ice melt were expected and a statistical approach was employed to dataset collection, focusing the majority of the cruise on sampling pre-defined transects in a grid across the Bay area intercepting areas with high and low ice/melt water distributions. This can be combined with satellite based observations to understand iceberg dynamics. Process studies were also conducted, tracking 3 large icebergs with concentric data collection within their vicinities to investigate the possibility of small scale responses to iceberg passage, incubating ambient seawater with additions of iceberg melt and/or sediment, and using repeat sampling of 'line F' in front of the Ilulissat Icefjord entrance to constrain short-term (diel) dynamics.

[Link to GLICE Cruise Page](#)

HYDEE-OBS	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Support of marine hydrate volume estimates by converted shear wave records	RV Tangaroa	21 - 31 March 2023	Dr Joerg Bialas	GEOMAR Helmholtz Center for Ocean Research Kiel	Germany

The overarching motivation of this project was to improve estimations of gas and gas hydrate distribution and concentration in a typical active subduction margin. During two days of mobilisation 20 four component ocean-bottom seismometers (OBS), a 300 m long high-resolution seismic streamer and a 150 cinch GI airgun sent from GEOMAR, Germany, were setup for operations. In addition, NIWA, New Zealand, provided a 20" compressor container. Besides the OBS all equipment was scheduled to serve for the following Eurofleets+ funded VISIT cruise as well in order to reduce logistical costs.

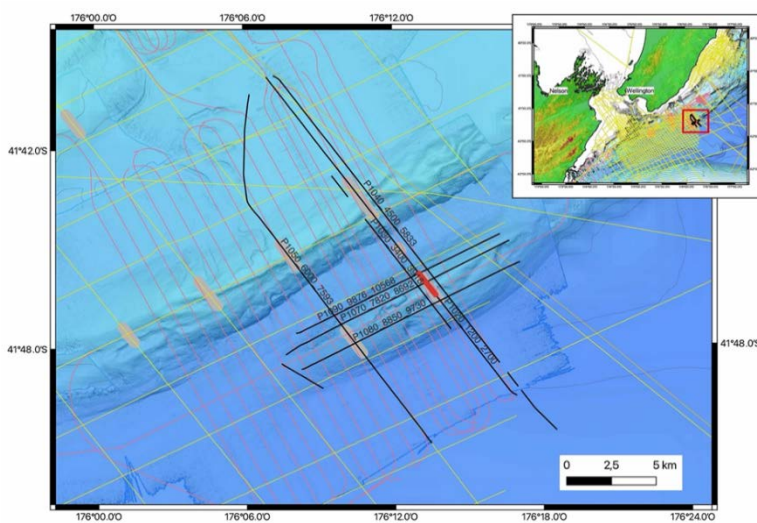


Figure 18 Map of the OBS deployment and multichannel seismic profiling completed during HYDEE-OBS

HYDEE-OBS working area was Honey Comb Ridge off New Zealand's North Island. Here data from previous cruises revealed an anomalous seismic event with a strong inverted amplitude, reaching from the depth of a bottom simulating reflector half way into the hydrate stability zone above. The aim of the seismic investigations during HYDEE OBS is to observe converted shear waves across these structure by the deployment of OBS. Adding information on lateral and depth distribution of shear modulus in sediments will enable to test for a possible co-existence of gas and

hydrate. To achieve these goals, the OBS deployments needed to be deployed at very precise locations at a distance of 100 m only and should not deviate from the desired line of profile. The RV Tangaroa's deep-sea cable, HIPAP USBL and dynamic positioning systems enabled each OBS to be positioned within +/- 5 m of the desired location. A 150 cinch GI airgun provided seismic source signals up to 300 Hz. First RV Tangaroa drifted at 1.5 kn across the deployed OBS to allow for the most dense shot spacing possible. Next the 300 m streamer was deployed and three additional airgun lines were shot. One across the line of OBS and two additional at 500 m distance left and right of the line of OBS.

Due to bad weather forecast the OBS were recovered after these lines and all data were copied and stored. Further streamer data were recorded afterwards to provide high-resolution, high-frequency data in the working area. The data sets will provide different resolution and frequency dependent images of the hydrate related structures. Adverse weather conditions required recovery of all gear in the afternoon of 28th March and a return to port two days earlier than planned.

Hydee-Obs poster including some preliminary results can be viewed [here](#) and the Hydee-Obs Cruise page [here](#).

VISIT	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Variation in subduction inputs along the Hikurangi subduction margin	RV Tangaroa	31 March - 11 April 2023	Dr Rebecca Bell	Imperial College, London	UK

Subduction plate boundary faults are capable of generating some of the largest earthquakes and tsunamis on Earth, such as the magnitude 9.0, 2011 Tōhoku earthquake, Japan. However, in the last two decades a new type of seismic phenomena has been discovered at subduction zones globally: slow slip events (SSEs). These are transient episodes of fault slip that are faster than tectonic plate motion but too slow to incite seismic waves and shaking. The physical mechanisms that lead to SSEs remain poorly understood and their potential to trigger highly destructive earthquakes and tsunamis on faults nearby is unknown, making slow slip a new and uncharted aspect of earthquake hazards.

The Hikurangi margin, North Island, New Zealand accommodates oblique subduction of the Pacific Plate beneath the Australian Plate at a rate of 4.5-5.5 cm/yr. Geodetic data reveal that the south Hikurangi plate boundary fault is locked to ~ 20-30 km depth, with deep SSEs occurring down-dip of this zone between 30 and 45 km depth. This deep, strong locking is thought to be a proxy for earthquake

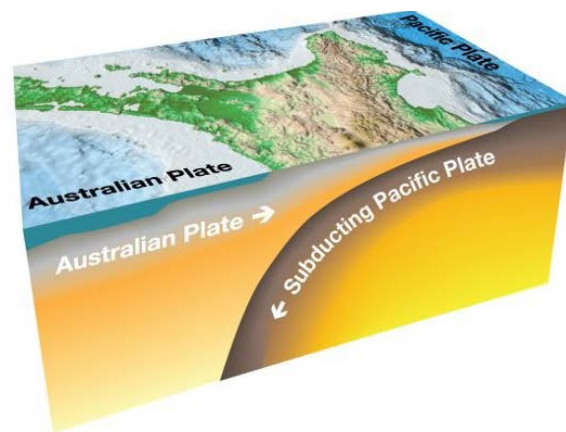


Figure 19 The Hikurangi subduction zone, North Island, New Zealand.

potential. The margin exhibits a sharp and profound along-strike transition in inter-seismic locking at latitude 40oS, with shallow SSEs occurring to the north. The physical properties and processes responsible for controlling the dramatic change in inter-seismic locking depth and fault slip behaviour at 40oS on the Hikurangi subduction zone are poorly understood.

The aim of the VISIT cruise is to test whether along-strike changes in the thickness, composition or physical properties of the Eocene-Pliocene pelagic sediments on the incoming Pacific plate are responsible for the sharp, along-strike differences in inter-seismic coupling and seismic behaviour observed along the Hikurangi margin, and whether similar changes in sediment properties could be responsible for controlling seismic behaviour at other subduction zones.

The cruise plan was to collect 2D seismic reflection data across a broad region of the Hikurangi Plateau. The total time period at sea enabled 7.5 days of continuous data acquisition that resulted in 1400 kilometres of seismic profiles. There were 2.5 days' downtime due to adverse weather. Approximately 1000 of the total line kilometres were collected in the planned survey area east of North Island on the Hikurangi Plateau. Poor weather at the end of the voyage meant no further data could be collected off the North Island's east coast so the vessel transited south to collect data in Cook Strait which can support future research planned by the cruise participants. Overall the cruise was successful and enabled the collection of sufficient data to tackle each of the research objectives. Go to the [VISIT Cruise Page](#) for more information including cruise report.

OASIS	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Thriving Cold-Water Coral Reefs in the Mediterranean Sea	RV Pelagia & ROV Max Rover	31st March - 12th April 2023	Dr Claudio Lo Iacono	Spanish National Research Council	Spain

OASIS Cruise was conceived to gain an advanced understanding of the functioning of Cabliers cold-water coral (CWC) reefs, in the eastern Alboran Sea, whose optimal state of conservation and large extension of thriving scleractinian communities make a unique and large biodiversity oasis compared to the entire Mediterranean deep-sea realm. During OASIS, Cabliers reefs was revisited 8 years after the last survey to expand the area of study and to monitor, over a 1-year time span, the hydrographic, hydrodynamic and sedimentary processes maintaining these ecosystems in unexpected thriving conditions. Moreover, OASIS exploration was extended to Catifas mound system, an analogous system located 13 nm East of Cabliers, which unveiled new thriving CWC communities.



Figure 20 OASIS cruise Area



Figure 21 Still from ROV dive OASIS-3 showing thriving colonies of *L. pertusa*.

During the cruise, detailed high-resolution multi-beam data was acquired on north Cabliers and Catifas systems. 15 ROV dives were conducted to explore and characterize the benthic fauna of the area resulting in the acquisition of 31 hours and 40 minutes of ROV video footage. Dense and pristine glass sponge grounds (*Asconema setubalense*) was found on the shallower dive of Cabliers province. Furthermore, 4 vertical volcanic walls were explored during OASIS, unveiling a dense, well grown and preserved assemblages of anthipatarians and gorgonians. Large

individuals and total absence of litter or evidence of fishing activities confirm the extremely well preserved and not impacted status of conservation of these deep-sea oases.

For further information including cruise report, visit the [OASIS Cruise webpage](#).

2.1.1 Oceans Call Cruise Statistics

Cruise Name	Lead PI	PI Gender	No. Participating Scientists (including remote)	SCIENCE TEAM F	SCIENCE TEAM M	Early Career Researchers	No. Participating Nationalities
Focus-AUV	Joshu Mountjoy	M	22	11	11	11	5
PORO-CLIM	Steve Jones	M	19	6	13	7	6
iMAR	Telmo Morato	M	16	7	9	3	7
GSHARK	Diego Bernal	M	16	5	11	5	5
BENCHMARK	Julian Burgos	M	10	6	4	3	3
CALYPSO	Shaun Johnston	M	13	4	9	3	5
TAIPro2022	Katrin Schroeder	F	14	9	5	0	6
SENERGY	James Waggitt	M	11	7	4	10	3
IOPD	Wieter Boone	M	8	2	6	8	4
GLICE	Mark Hopwood	M	6	2	4	2	5
VISIT	Rebecca Bell	F	11	5	6	4	3
HYDEE-OBS	Joerg Bialas	M	9	2	7	2	3
OASIS	Claudio Lo Iacono	M	7	4	3	3	7
Total		11 M 2 F	162	70	92	61	Average 4

2.2 Regional Call Implemented Cruises

The following ten cruises were implemented out of 17 proposals recommended for scheduling by the Scientific Liason Panel. This resulted in a total of 92 days' shiptime access for researchers to research vessels and marine equipment.

Cruise Name	No. of Days Granted	Discipline	Lead Organisation	Location	Region
MYRTOON	10	Climate dynamics	Heidelberg University, Germany	Myrtoon Basin	Mediterranean
PHYCOB	7	Biological Oceanography	AWI, Germany	Western Black Sea	Black Sea
GRASSMAP	7	New technologies, Marine Biology	University of Southampton, UK	Mallorca Island	Mediterranean
GRACE	11	Geology, Geophysics, Physical Oceanography, Sedimentology	University of Lille/CSIC Spain	Ceuta Canyon	Mediterranean
CABLE	8	Biological & Physical Oceanography	Tallinn University of Technology, Estonia	Gulf of Finland	Baltic Sea
FIGURE	8	Biological & Physical Oceanography, Biogeochemistry, Microbiology	CYBELE, France	Gulf Stream (NW Atlantic)	North Atlantic
CARBO-Acid	10	Biogeochemistry, Marine Chemistry, Physical Oceanography	IPMA, Portugal	Iberian margin	North Atlantic
SINES	9	Biogeochemistry	Centro de Ciências do Mar do Algarve, Portugal	Western Iberian Margin	North Atlantic
ERODOTO	12	Deep Sea Research, Geology, Geophysics	OGS	Squillace Canyon, Italy	Mediterranean
POSEIDON	10	Geophysics	CSIC	Greek Ionian Islands	Mediterranean

Most of the Regional Call cruises took place in the Mediterranean followed by the North Atlantic and 1 cruise each took place in the Baltic and Black Seas.

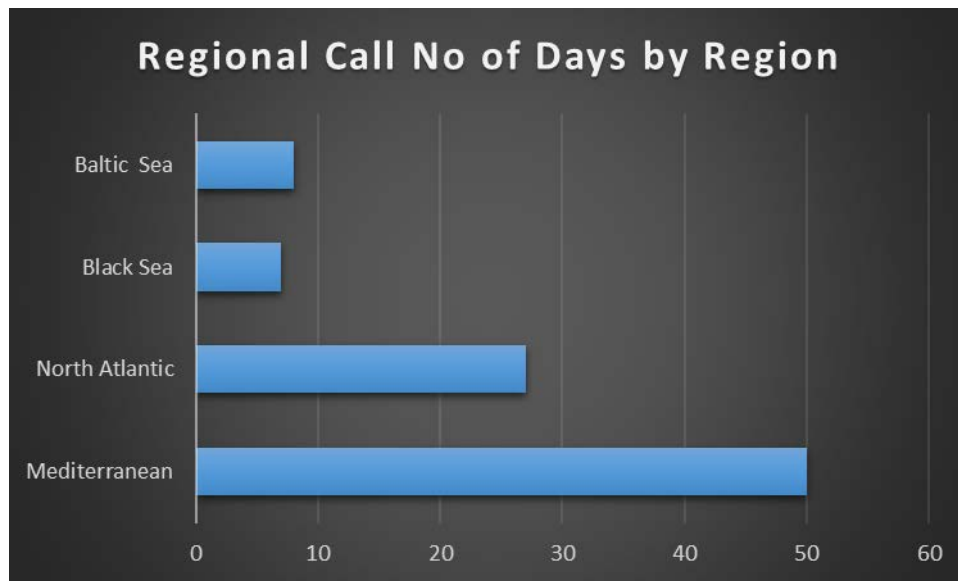


Figure 22 Regional Call Cruise Regions

MYRTOON	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Climate Dynamics and Environmental Change in the Aegean Sea during the Holocene	RV Aegaeo	30th September - 9th October 2021	Dr Andreas Koutsodendris	Heidelberg University	GERMANY

'MYRTOON' (Climate Dynamics and Environmental Change in the Aegean Sea during the Holocene) focused on investigating the potential influence of climatically and neotectonically driven environmental change on critical sociocultural transitions in the SW Aegean Sea region over the Holocene. Surrounded by the landmasses of the Peloponnese, Attica, and the Cyclades Islands, the study area comprises one of the few regions in Europe that has been continuously inhabited since Neolithic times, and it holds a central position within the ancient core locations of the Cycladic, Mycenaean, and Classical Greek civilizations.

During the cruise, geophysical surveys (multibeam, Airgun, and Sparker profiling) were combined with sediment coring (gravity and box corers) in the Argolikos and Myrtoon Basins of the SW Aegean Sea. Specifically, mapping of the seafloor and the sub-surface with multibeam (total surface of c. 1200 km²), Airgun and Sparker echosounders (total line length of c. 584 and 164 km, respectively) allowed to investigate tectonic structures and sub-marine landslides in the study region. In addition, sedimentological, micropaleontological and geochemical analyses on core sediments (from seven gravity and three box cores) will allow to reconstruct the natural terrestrial ecosystems on these landmasses, ultimately resolving the environmental conditions during the rise and fall of early cultures in the southern Aegean Sea region.

Visit the [Myrtoon Cruise Webpage](#) for more information.

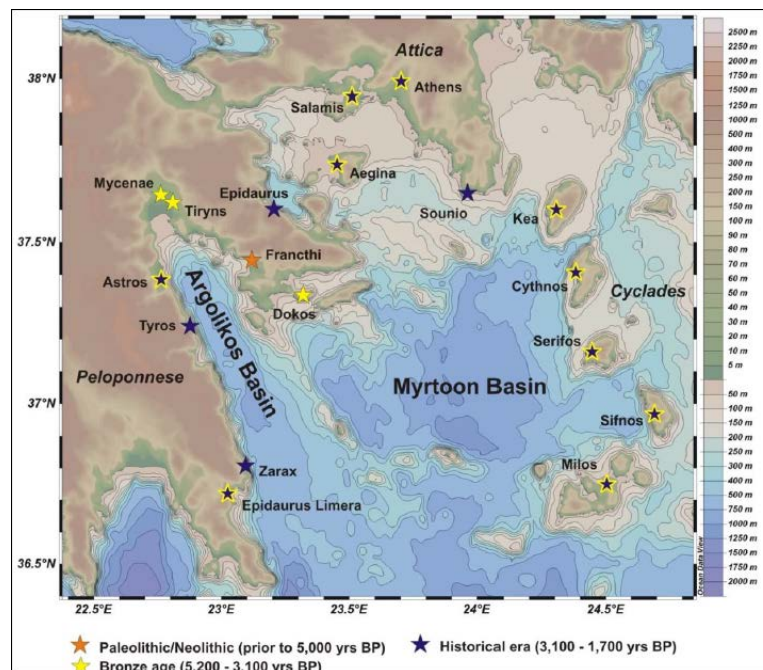


Figure 23 Map of the MYRTOON study area indicating important archaeological sites in the surrounding landmasses.

PHYCOB	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Assessment of phycotoxins and their producing species in the Black Sea	RV Tübitak Marmara	11th - 17th Sept 2021	Dr Bernd Krock	Alfred Wegener Institut-Helmholtz Zentrum für Polar- und Meeresforschung	GERMANY

PHYCOB's main scientific objectives were: 1) To assess the presence of toxic microalgae in the plankton assemblage of the Western Black Sea. 2) To quantitatively determine the spatial distribution of toxic phytoplankton species and their corresponding toxins in the plankton. 3) To quantitatively describe the spatial distribution of toxic phytoplankton resting stages in surface sediments and determine hotspots of recruitment and bloom initiation. 4) To define correlations among hydrographic and/or meteorological conditions and occurrence of HAB species. 5) To characterize the plankton communities accompanying HAB species together with toxin analysis of size fractionated samples. 6) To identify heterotrophic dinoflagellates, ciliates, or other small zooplankton as possible toxin vectors. 7) To isolate toxic Black Sea microalgal species and establish monoclonal cultures for characterization of Black Sea strains. 8) To perform an interseasonal comparison of toxigenic plankton species by combining the data sets collected during the RV Akademik cruise that was performed in May/June 2019 with our data from summer. 9) To compare the data set from the Western Black Sea to the Southern (North-) Western North Sea, Baltic Sea and West Greenland obtained during earlier expeditions for site comparisons.

The cruise started on 11th September with about two and a half days delay due to bad weather conditions in the Black Sea. The first station was reached the following morning and the sampling and sample processing was performed as scheduled. During the entire cruise four stations per day were performed without any hindrance or problems. Deck work consisted of CTD casts including five deep CTD casts to 1000 m depth at stations 1, 4, 12, 15 and 23, two vertical plankton net hauls at all stations and boxcorer sediment samples at the shallower stations 6-11 and 16-19. After completion of all stations in the afternoon of 17th September, RV TÜBITAK MARMARA returned to Istanbul.

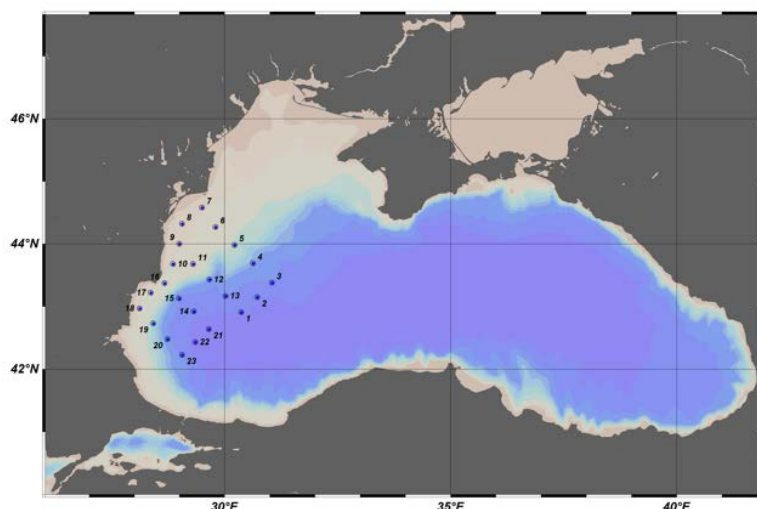


Figure 24 PHYCOB Working Area and track chart

Visit the [PHYCOB Webpage](#) for more information including a cruise report and video of PHYCOB cruise activities.

GRASSMAP	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Scalable seagrass mapping using deep learning	RV SOCIB	14th - 20th September 2021	Miguel Massot Campos,	University of Southampton	UK

The GRASSMAP project aims to demonstrate in situ capabilities for current state of the art platforms to enable remote awareness by removing common bottlenecks such as post-processing and classification of recorded underwater imagery. The methodology will be applied for the assessment of endemic seagrass species (*Posidonia oceanica*) in the Mediterranean using three different untethered platforms: an Autonomous Underwater Vehicle (AUV), an Autonomous Surface Vehicle (ASV) and a Lagrangian Drifter (LD).



Figure 25 GRASSMAP Science Team

Posidonia oceanica (PO) is a seagrass with an extremely high ecosystemic value, as it provides shelter and oxygen to marine creatures, stabilizes the seabed, increases seafloor roughness breaking swell and wind-driven waves, encouraging the deposit of sedimentary particles [PI21]. It acts as a host to actual filterers such as sponges and provides the Balearic islands with their famous crystalline waters. Until recently, seagrass exploration has been carried out manually by divers. These dangerous, expensive and time-consuming tasks can be replaced with innovative underwater exploration approaches using Autonomous Underwater Vehicles (AUVs) and Artificial Intelligence (AI) guided image classification.

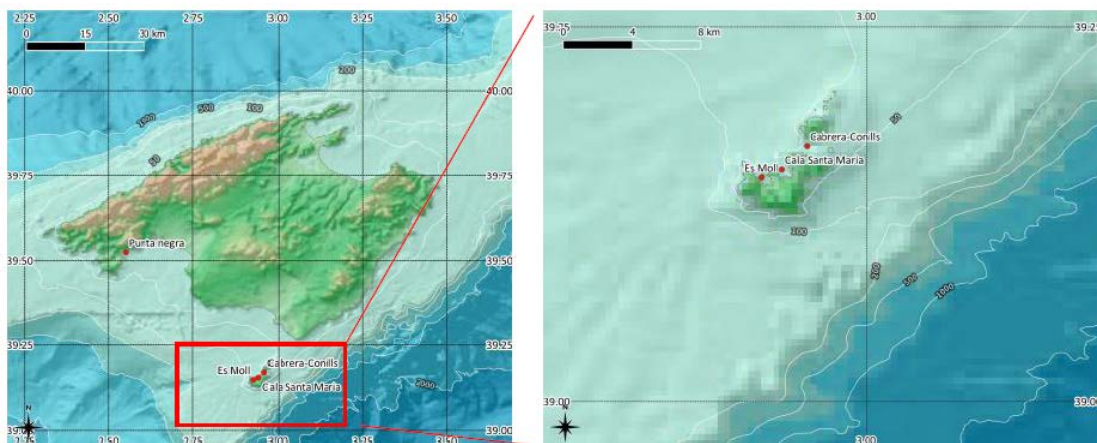


Figure 26 GRASSMAP Working area - Marine Protected Area of Cabrera Archipelago

The GRASSMAP main work area is at Cala Santa Maria (CSM), located in a Marine Protected Area (MPA) in the Cabrera Archipelago. The area was selected due to the low human impact, as anchoring is not permitted in the MPA waters, providing a representative baseline for an undisturbed location. More information on GRASSMAP is available [here](#).

GRACE	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Geo-hazaRds Along the CEuta Canyon	RV Belgica & AUV Barabas (VLIZ)	28 April - 11 May 2022	Carmen Juan Valenzuela	1ST AFFILIATION - Instituto Español de Oceanografía, CO Cádiz (Spain); 2ND AFFILIATION – Lille University, Laboratoire d'Océanologie et de Géosciences (France)	SPAIN/FRANCE

The GRACE cruise studied the geological risks associated with the Ceuta Canyon and its adjacent areas. The Ceuta Canyon is a largescale downslope feature at the westernmost end of the Mediterranean Morocco margin. Its location is tectonically controlled, and seems to be related to onshore active structures. Its head (located close to the coast) and its eastern margin are affected by arcuate shaped scars, and in addition the area is deeply influenced by vigorous bottom currents that cause erosion on its margins and the rapid growth of the adjacent Ceuta Drift.



Figure 27 GRACE Team Onboard the RV Belgica

This complex context raises concerns regarding the high exposure of coastal populations and key infrastructures to geohazards. For that reason, the GRACE cruise tackled the task of gathering the necessary data to evaluate such geohazards with a multidisciplinary approach, focusing on the sedimentary processes, chronostratigraphy, oceanography. Last, the incorporation of an AUV allowed obtaining knowledge of the submarine features with unprecedented precision, providing higher resolution datasets than those achieved from surface vessels with traditional techniques.

This cruise means a key advance in the knowledge of major features such as the Ceuta Canyon and the adjacent Ceuta Drift, as well as on the analysis of their associated geohazards, and the results obtained will allow a safer planning and management of coastal and submarine infrastructures, and of biological communities.

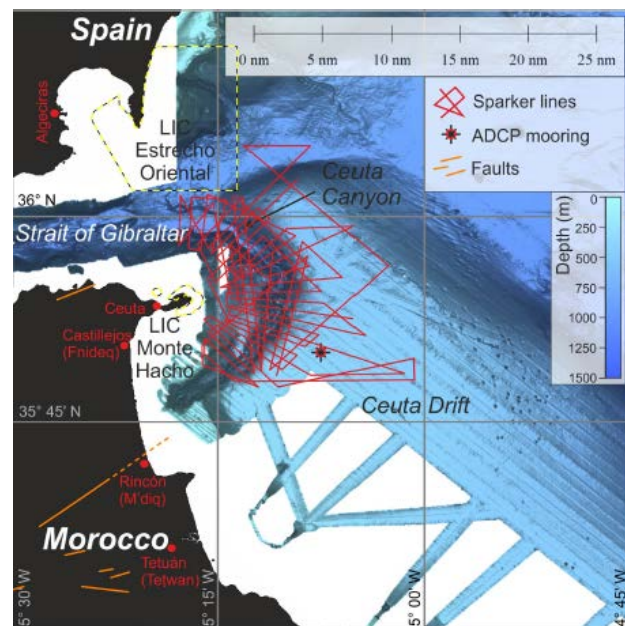


Figure 28 Working area and Sparker track chart of GRACE Cruise.

More information on GRACE [here](#) and a poster outlining GRACE activities can be accessed [here](#).

CABLE	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Central Baltic Sea Circulation Experiment	RV ARANDA	Leg 1 22-29th April & Leg 2 10-13th October	Dr Taavi Liblik	Tallinn University of Technology	Estonia

The primary goal of CABLE was to deploy/recover moorings and profiling/sampling was done as much as time schedule and weather allowed. Due to COVID-restrictions the originally planned cruises in Spring and Autumn 2021 were postponed to 2022. In the meantime, currents were investigated in the Baltic Proper (Liblik et al., 2022). As a result of the new findings it was decided to shift the mooring array to further north. The main purpose of the change was the fact that the simulation results hinted Farö sill as important spot for deep water exchange between Central Baltic Proper and Northern Baltic Proper. Two cruises were arranged to study the circulation and current structure of the Baltic Sea.

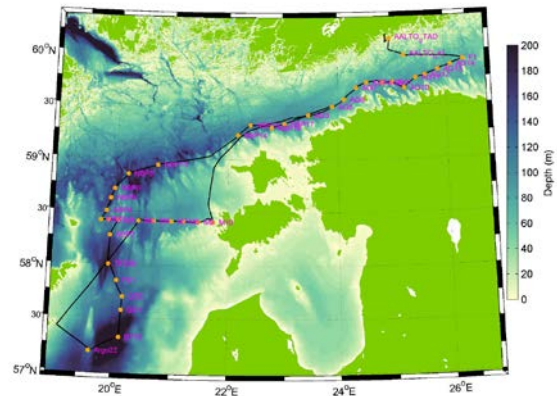


Figure 29 Cable Leg 1 Work Area & Track Chart

The main objectives/activities of the leg-1 cruise were: deploy current-meter moorings to the central Baltic Sea; deploy wave buoys and current meter mooring to the Gulf of Finland; replace wave buoy near Gotland Island; recover Argo float in the Eastern Gotland Basin; conduct vertical profiling and sampling for nutrient analyses in the zonal transect in the Baltic Proper and at the transect from the southern Baltic to the Gulf of Finland; collect surface sediment samples and sediment cores from selected stations. In addition to the Eurofleets+ funded four days, the cruise was funded by two days by FMI. We experienced unusually strong wind for the spring season in the CABLE leg-1. Work was stopped twice due to heavy wind and high waves. However, all planned activities were carried out.

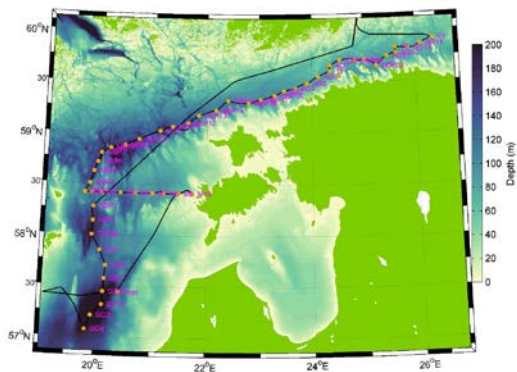


Figure 30 Cable Leg 2 Work Area & Chart

The main objectives of the leg-2 cruise were: to recover current-meter moorings from the central Baltic Sea; replace wave buoy near Gotland Island; recover Argo float in the Eastern Gotland Basin; conduct vertical profiling and sampling for nutrient analyses in the zonal transect in the Baltic Proper and at the transect from the southern Baltic to the Gulf of Finland; replace mooring in the H2O station; collect surface sediment samples and sediment cores from selected stations for the Co-PI project DOMUSE. Weather allowed us to work most of the time and all planned activities were carried out.

More information on the CABLE cruise is available [here](#).

FIGURE	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Fine scales shaping nitrogen fixation in the Gulf stREam	RV Atlantic Explorer	21 st – 30 th July 2022	Dr Mar Benavides	Mediterranean Institute of Oceanography, France	FRANCE

The FIGURE-CARING cruise departed from Bermuda on 21st July 2022 towards the Gulf Stream. After a test station, two transects were sampled:

- North (crossing a cyclonic eddy and the Gulf Stream), 8 stations (8x2000m casts + 6x200m casts)
- South (crossing the Gulf Stream $\sim 1^\circ$ latitude below), 4 stations (4x1600m casts)

Once the station transects were completed, the North transect was repeated performing underway sampling at 6 kn navigation speed.

The biological fixation of dinitrogen (N₂) by marine microbes called ‘diazotrophs’ sustains $\sim 50\%$ of primary production in the ocean, boosting CO₂ absorption and mitigating climate change. Our knowledge of diazotroph diversity and activity (diazotrophy) derives from studies conducted at very distant spatiotemporal scales: i) discrete and short duration measurements in small seawater volumes isolated from the environment, and ii) spatial extrapolations and global models of diazotrophy projected over decades to centuries. The knowledge gap between these spatiotemporal scales impedes constraining nitrogen inputs and thus quantify and predict the ocean’s potential to withdraw CO₂. This gap lies at the fine scales: dynamic seawater structures $<200>10\text{-}50$ times faster than those available today, focusing on the Gulf Stream. Fine scales will be characterized by underway sensors of current speed, temperature and salinity, vertical nutrient fluxes and satellite altimetry data. The community composition will be examined by molecular biology methods. Diazotroph activity will be measured using high sensitivity trace gas analysis. Physical and biological data will be correlated to elucidate the effect of fine scales on diazotrophy and to assess their impact on nitrogen inputs to the ocean. The achievements of FIGURE will imply a break-through advance in oceanography and stimulate applications in biotechnology and environmental science, providing new tools, approaches and knowledge for climate change

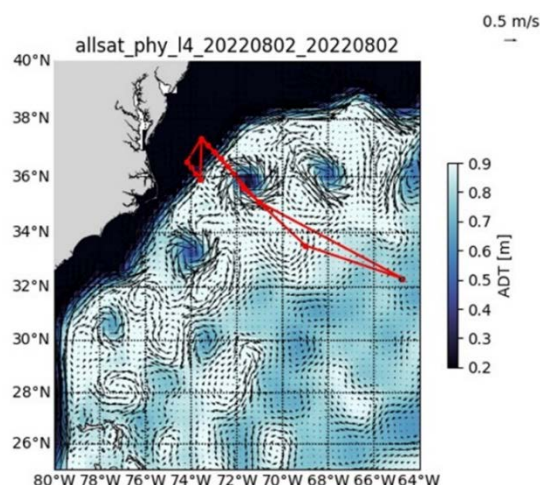


Figure 31 FIGURE Working Area and Track Chart



Figure 32 FIGURE Cruise Team

adaptation and mitigation.

More information on FIGURE including cruise report is available [here](#).

CARBO-Acid	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Investigating the Potential Effects of Ocean Acidification on Marine Carbonate Organisms along the Iberian Margin Coastal Upwelling System	RV Ramon Margalef	3 - 12 August 2022	Dr Emilia Salgueiro	Instituto Português do Mar e da Atmosfera	Portugal



Figure 33 Carbo-Acid On-board Scientific Team

The main objective of CARBO-Acid was to collect data and samples to study the potential effects of ocean acidification on carbonate marine organisms (coccolithophores, pteropods, planktonic and benthic foraminifera, and corals) along the Iberian margin. With this objective, oceanographic data and water samples, plankton, cold-water corals and sediment samples were collected during an upwelling season, along two transects coinciding with the two persistent upwelling filaments off the Iberia Margin: the Cape Finisterra and the Cape Roca. During the cruise a total of 7 stations were completed, 4 stations along the Cape Finisterra transect (from W to E: CA3, CA2, CA7, CA8) and 3 stations at the Cape Roca (from W to E: CA6, CA5, CA4) transect. At each station a multibeam survey, a CTD and Rosette cast took place. These initial operations allowed to identify the different water masses present in this area, characterize their physical properties and to recover seawater samples at specific depth levels. At each station, two vertical tows with a plankton multinet (with 5 nets) were done on the top 700m of the water column to sample the planktonic communities of the different water depths. A total of ten box-cores and fifteen Shipek grab samples were collected at the Fontanelas seamount (Estremadura Spur), station CA6, to characterize the sedimentary cover and to evaluate the presence of deep cold-water corals. Preliminary results show that the stations CA7, CA8 and CA4, located close to the coast, are the most influenced by the coastal upwelling, exhibiting colder surface water, higher values of fluorescence, and more zooplankton content reflecting higher phyto-zooplankton concentrations, as typical of the upwelling waters. The detailed CA6 bathymetry allowed to verify the existence of small plateaus on the slope of the Fontanelas seamount, where the fossil cold-water corals fragments were found, suggesting that this area is a very interesting system deserving further study with a ROV, and to characterize the corals fields and verify if there are live corals. More information on Carbo-ACID is available on the cruise webpage [here](#) and poster [here](#).

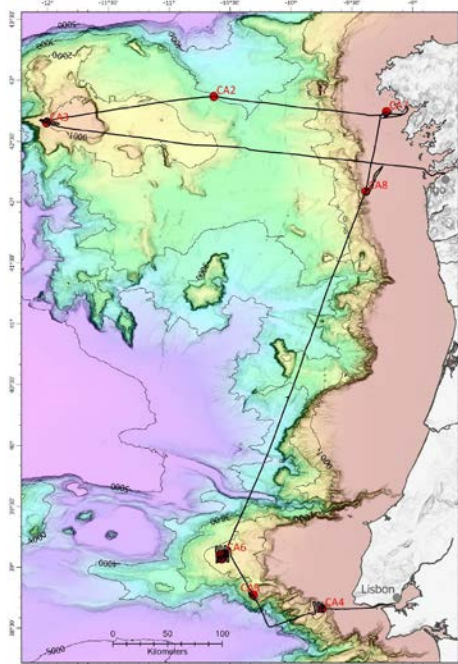


Figure 34 Carbo-Acid Work Area & Stations

SINES	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	CLIMATE CHANGE IMPACT ON OCEAN FRONTS ECOSYSTEMS: The case of the Iberian Upwelling System	RV Sarmiento de Gamboa	11 - 20 September 2022	Dr Marcos Fontela	Centro de Ciências do Mar do Algarve,	Portugal



The overall objective of this study was to identify the changes and risks for marine ecosystem services deriving from the potential impact of climate change on upwelling fronts, by concentrating on the ecosystem variability of the Iberian Margin upwelling system through a holistic and integrative research approach, joining forefront remote technologies to in situ monitoring and numerical modelling. The aim was to address ecosystem-societal interactions

through the identification of the best quantifiable descriptors that are essential for sustainable management. The project hopes to address societally relevant topics, such as blue carbon economy, coastal-open ocean exchanges, mesoscale subduction processes, and air-sea CO₂ fluxes. The socioeconomic importance of the Iberian Upwelling stimulates the collection of an interdisciplinary database of observations.

The proposed multidisciplinary expedition was carried out along a section across the expected upwelling front between 37°N 9°W and 38°N 12°W. Water column, plankton, and bottom sediments were collected at 15 stations. Chemical analyses for dissolved oxygen, pH, and total alkalinity were already performed onboard (19 CTD casts); for phytoplankton, micro- and mesozooplankton respectively, 12 vertical multinet hauls were collected. Bottom sediments were collected by box-core at the stations where known bottom conditions were safe for operation. Sediment cores were split in half so the same core could be used to calibrate proxies used for paleoreconstructions and for studying micro and macrobenthic communities. Furthermore, given the large number of analyses planned to be done on the different water samples, at four of the stations, CTD-rosette casts were repeated (shallow and full-depth casts). The complete list of events within the software EARS (“Eurofleets Automatic Reporting System”), the tool for logging events developed by EUROFLEETS, registered 58 operation events during the cruise.

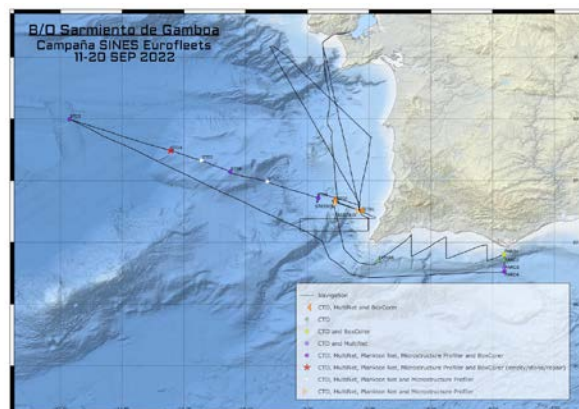


Figure 35 SINES Working Area and Track Chart

More information including cruise report is available on the SINES [webpage](#) and SINES poster is accessible [here](#).

ERODOTO	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	EROSive Dynamics Of The Squillace submarine canyOn	RV Aegaeo, ROV Max Rover, VLIZ AUV Barabas	1-12 July 2023	Dr Silvia Ceramicola	OGS	Italy

ERODOTO proposes to analyse and quantify the active dynamics of a shelf-incising, close-to-shore submarine canyon as a model for geohazards assessment and risk management. The case study of the upper Squillace Canyon offshore southern Italy, that has a close connection to ephemeral river systems regionally known as 'fiumare' (Sabato and Tropeano, 2004) will be used to measure and quantify the effect of retrogressive erosion induced by repeated sediment flows and assess its hazard in order to develop a methodological approach that can be used in other canyon systems to define precise monitoring programmes and efficient risk management plans.

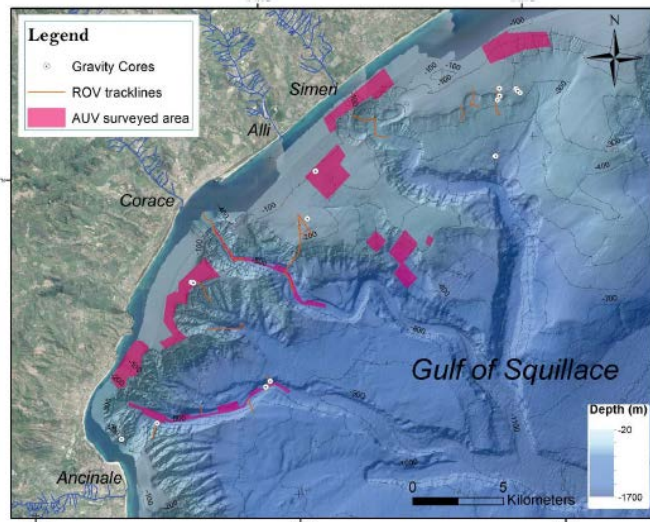


Figure 36 ERODOTO Surveyed Area and track lines

ERODOTO cruise had four specific objectives: 1) Detailed documentation of canyon head morphologies 2) Quantification of the dynamics of sediment flows in the combined fiumare-canyon system 3) Assessment of the geotechnical properties of the shelf sedimentary sequences incised by the headwalls 4) Development of a blueprint for coastal hazard assessment and monitoring.



Figure 37 ERODOTO Onboard Team

During the 10-day data acquisition period, 11 ROV dives and 8 AUV missions were completed, 14 gravity cores were obtained and 1 CTD cast as well as 200Km² of multibeam data acquired. 4 pushcores and 4 rock samples were acquired during the ROV dives.

The post-cruise processing and analyses will be carried out in synergy between both onboard and onshore team. The necessary funding for data processing and interpretation will be provided by OGS in cooperation with the National Recovery and Resilience Plan Project *RETURN Multi-risk science for resilient communities under a changing climate*.

<https://www.cimafoundation.org/en/project/return/>

More information including cruise report is available on the [ERODOTO Webpage](#).

POSEIDON	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Seismic Hazard in the west Peloponnese - Ionian Islands DomainN	RV Laura Bassi	June 12 - 22 2023	Prof Dr Cesar Ranero	Consejo Superior de Investigaciones Cientificas (CSIC)	SPAIN

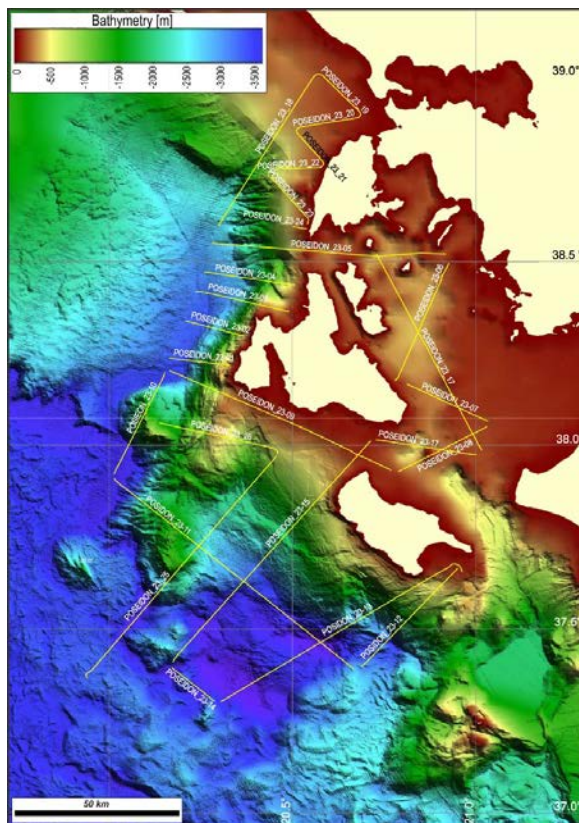


Figure 38 Bathymetric Map of the Poseidon Study Area

The POSEIDON cruise comprised the acquisition of marine geophysical data as a collaborative effort of Spanish, Italian and Greek scientists. The POSEIDON cruise aimed at studying arguably one of the most complex and comparatively little evaluated regions with demonstrated high seismic hazard in the Mediterranean: The western Peloponnese & Ionian Islands tectonic domain. Here, a complex fault system occurs across an area with a dramatic change in deformation rates, purportedly near the end of the Hellenic subduction zone. The fault system produces numerous large earthquakes, mostly offshore, recorded in the onshore Greek seismological network during the last decades. However, some events are poorly known, like the Cephalonia 1953 Mw~6.8 event, possibly the most destructive earthquake in recent Greek history. The 1953 event caused the collapse of 85% of all buildings on the Island of Cephalonia, ~1000 deaths, and ~145k homeless, and initiated a long-term population migration affecting the local economy, that has only recently started to heal. Even today, the causative fault is unknown, which is aggravated because the tectonic map of the region remains

poorly defined. A thrust-fault focal mechanism E-SE of Cephalonia is proposed to have caused the 1953 event with a hypocenter depth between <50 km to <20 km, depending on the analysis. However, geological studies onshore in the islands propose that active shallow (<~5 km) thrusting ruptured by the 1953 event. Limited high resolution bathymetry available to date across much of the region indicates complex fault structure and kinematics. The POSEIDON research region has developed above the edge of the subducting slab, which is bounded to the NW by a tear. In order to study the early stages of a Subduction-Transform Edge Propagator (STEP) fault system. POSEIDON aims are threefold and will A) Answer major open issues regarding faulting and natural hazards in the region, B) Address fundamental questions of earthquake phenomena, and C) Expand understanding in basic research related to subduction systems and STEP evolution. For further information see the POSEIDON [Cruise webpage](#).

2.2.1 Regional Call Cruise Statistics

Cruise Name	Lead PI	PI Gender	No. Participating Scientists (including remote)	SCIENCE TEAM F	SCIENCE TEAM M	Early Career Researchers	No. Participating Nationalities
MYRTOON	Andreas Koutsodendris	M	15	11	11	10	6
PHYCOB	Bernd Krock	M	9	2	7	5	6
GRASSMAP	Miquel Massot-Campos	M	8	2	6	2	3
GRACE	Dr Carmen Juan Valenzuela	F	14	9	5	6	6
CABLE	Dr Taavi Liblik	M	14	3	11	8	4
FIGURE	Dr Mar Benavides	F	10	8	2	3	4
CARBO-Acid	Dr Emilia Salgueiro	F	8	6	2	3	4
SINES	Dr Marcos Fontela	M	24	12	12	11	4
ERODOTO	Dr Silvia Ceramicola	F	7	5	2	0	3
POSEIDON	Dr César Ranero	M	9	7	2	0	5
TOTAL		6 M, 4 F	118	58	60	48	Average (4)

2.3 Running Calls Implemented Projects

Two running calls were implemented during the project calling for proposals that could be implemented alongside already funded Eurofleets+ cruises or on a Eurofleets+ vessel. The projects below were implemented.

Cruise Name	No. of Days Granted	Discipline	Lead Organisation	Location	Region
SEAQUAKE	3	Geology, Geophysics, Sedimentology	CSIC	Ceuta Canyon	Mediterranean
DoMUSE	1	Biological Oceanography, Biogeochemistry	IOPAN	Gotland Deep Baltic Sea	Baltic Sea
CARING	2	Biogeochemistry, Physical Oceanography	IFREMER	Gulf Stream	
UNSEEN	1	Biological Oceanography, Pollutants or aerosols, Sedimentology	CNR	Cabliers Cold Water Coral Province	Mediterranean
ISOMED	n/a	Biological Oceanography, Biogeochemistry, Geochemistry, Marine Ecology	SZN	Tyrrhenian Sea & Ligurian Sea	Mediterranean

2.3.1 Co-PI Projects

SEAQUAKE	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Unveiling the coseismic rupture of an active submarine fault in the Alboran Sea	RV Belgica_AUV Barabas	28 th April – 11 th May 2022 (during GRACE cruise)	Sara Martínez Loriente	Institute of Marine Science (<i>Institut de Ciències del Mar</i> del CSIC)	Spain

SEAQUAKE took place during the GRACE cruise led by Dr Carmen Juan Valenzuela of CSIC, Spain onboard the RV Belgica and utilising the AUV Barabas. The main goal of the SEAQUAKE cruise was to corroborate the eastern offshore continuation of a fault identified along the northern coast of Morocco.

Benckroun et al. (2013) defined this structure as a normal fault with a surface rupture length of 20 km and a seismogenic potential to generate an earthquake of M 6.6. This fault would correspond to an inherited structure from the Jurassic transfer zone that would be reactivated during the Neogene convergence. SEAQUAKE acquired around 240 NM (430 km) of high-resolution bathymetric data using the multibeam (MB) echosounders hull-mounted on the RV Belgica for deep (EM304) and shallow

(EM240) waters, 50 NM (90 km) of TOPAS sub-bottom profiles, ultra-high resolution AUV data using the VLIZ instrument, and 3 CTDs for calibration. Some Sparker seismic profiles acquired during the GRACE cruise showed that the SEAQUAKE target fault is not currently active, and does not show any signs of recent tectonic activity. Therefore, the initial acquisition plan was changed and signs of recent tectonic activity in the study area were looked for instead. To this end, a MB and TOPAS survey was planned crossing all scarps identified on the new high-resolution bathymetry acquired during the first day.

Do-MUSE	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Microbial Dissolved Organic Matter utilisation at the near-sediment waters in the Baltic Sea Deeps	RV Aranda	10-13th October 2022 (CABLE Leg 2)	Dr Alexandra Loginova	IOPAN	Poland

The Do-MUSE Co-PI project took place during the Eurofleets+ funded CABLE cruise led Dr Taavi Liblik of Tallinn University of Technology, Estonia. DoMUSE suggests that Dissolved Organic Matter (DOM) released from sediments may serve a substrate for heterotrophic methabolism in the near-bottom waters, which can be traced by measuring DOM qualitative and quantitative changes and siderophores accumulation. The goal of this project was to assess the bioavailability of DOM, released by sediments, and the potential stimulation of heterotrophic communities.

For this, the measurements of dissolved organic carbon (DOC), DOM size distribution and DOM optical properties, such as chromophoric (CDOM) and fluorescent (FDOM) DOM was accessed in the sediment pore waters of the Baltic Sea Deeps and in the water column to provide the starting composition of DOM. The development of the oxygen, nutrients, siderophores concentrations and temporal development of DOM constituents will be accessed during ex-situ incubations of the sediment cores with overlying water. That will help understanding of quantitative and qualitative transformations of DOM during the incubation time period. The measurements of siderophores accumulation, microbial abundance, oxygen and nutrient consumption will provide critical insights on the ability of sediment released DOM to serve as a substrate for heterotrophic communities to grow on and function.

CARING	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	CARbon Irrigation to the North-atlantic by the Gulf stream - CARING	RV Atlantic Explorer	21 st – 30 th July 2022 (during FIGURE cruise)	Dr Lidia Carracedo	IFREMER	FRANCE

The CARING Co-PI project was achieved utilising the RV Atlantic Explorer alongside the FIGURE Cruise led by Dr Mar Benavides of Mediterranean Institute of Oceanography, France. Over the past 200 years human activities have emitted large amounts of CO₂ into the atmosphere (namely anthropogenic carbon, C_{ant}) increasing the atmospheric CO₂ content to unprecedented levels. The ocean absorbs about 30% of these emissions, acting as a net sink. Of the ocean basins, the North Atlantic is the one with the highest storage of C_{ant} per area. Yet, it is still uncertain how much of the C_{ant} uptake occurs (locally) at subpolar latitudes or (remotely) in the subtropics; or what are the driving mechanisms ultimately regulating its storage at different temporal scales. CARING will provide a contemporary novel assessment of the downstream Gulf Stream carbon and nutrient transport and carbon uptake capacity conveyed by Gulf Stream intermediate

waters poleward, so as to elucidate its role as first-order far field control to the nutrient and carbon irrigation to the North Atlantic. The sampling strategy comprises CTD and discrete sampling of the first 2000 dbar of the water-column, and continuous high-resolution underway sampling, the latter targeted at assessing the impact of the fine scale. The achievements of CARING will provide a small but significant step-forwards into narrowing down the current gap of knowledge about the C_{ant} sink and storage variability, drivers, and related timescales.

UNSEEN	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	UNveiling microplaStic abundancE pattErNs on a pristine Cold Water Coral reef	RV Pelagia_ROV Max Rover	31 March – 12 April 2023	Dr Martina Piedromenico	Italian National Research Council (CNR)	Italy

The UNSEEN project was implemented on the RV Pelagia alongside the OASIS cruise led by Dr Claudio Lo lacono of CSIC, Spain. UNSEEN collected sediment, water and fauna samples across different sectors of the Cabliers Coral Mound Province to assess microplastic occurrence in different environmental compartments. The ultimate goal of the project will be pursued following an integrated approach aimed at: a) understanding the influence of oceanographic and sedimentary processes on the transport and emplacement of microplastics in deep-sea environments b) assessing potential impacts on CWCs species.

Examining microplastic occurrence and distribution patterns will provide significant insights into our understanding of transfer and accumulation pathways of microplastic across different aquatic compartments, including impacts on deep-sea ecosystem engineering species.

2.3.2 Remote Transnational Access (RTA) Project Implemented

ISOMED	Full Title	Vessel/Marine Equipment	Dates	PI Name	Lead Organisation	Lead PI Country
	Mapping the spatial distributions of stable isotopes in food webs of the Mediterranean Sea	RV Belgica	17th – 26th May 2022 (during TALPro22 cruise)	Dr Sarah Magozzi	Stazione Zoologica Anton Dohrn	Italy

The objective of ISOMED was to collect Mesozooplankton samples during the TalPro22 cruise led by Dr Katrin Schroeder of CNR. The samples will be sorted for *a priori* defined functional / trophic groups (e.g., herbivores, omnivores, carnivores, detritivores, bacterioves) expected to be isotopically different. Each group will be then analysed for stable C and N isotopes and data will use used to: 1) quantify between-group non-spatial isotope variance, and 2) augment a dataset for reference organisms representing the base of the food web, which will be used to develop models of the spatial variation of baseline isotopic compositions in the Mediterranean Sea (isoscapes) while accounting for non-spatial components of isotope variance.

Mesozooplankton were collected from two sites, by means of oblique trawling with a WP2 net equipped with 200 um mesh. Samples were then fixed in 70% ethanol as a preservative until stable isotope analyses.

The data generated from the analyses of these specific samples will be uploaded to the EMODnet Data Ingestion portal once the data is available.

Station No.	Date	Time	Longitude	Latitude	WaterDepth	Gear
	2022	[UTC+1]	[decimal degrees E]	[decimal degrees N]	[m]	
CTD013	20.5	11:10	11.5697	40.1103	NA	WP2 net
DYFAMED	25.5	17:16	7.869	43.417	NA	WP2 net
DYFAMED	25.5	17:51	7.869	43.417	NA	WP2 net
DYFAMED	25.5	18:12	7.869	43.417	NA	WP2 net

Table 3 ISOMED Stations

2.3.3 Running Call Cruise Statistics

Cruise Name	Lead PI	PI Gender	No. Participating Scientists (including remote)	SCIENCE TEAM F	SCIENCE TEAM M	Early Career Researchers	No. Participating Nationalities
SEAQUAKE	Sara Martínez Lorient	F	4	2	2	1	1
DoMUSE	Alexandra Loginova	F	1	1	0	1	1
CARING	Lidia Carracero	F	2	1	1	0	2
UNSEEN	Martina Pierdomenico	F	1	1	0	0	1
ISOMED	Sarah Magozzi	F	3	2	1	1	1
Total		5 F	11	7	4	3	1 (average)





















3 Virtual Access

No virtual access statistics are available as all infrastructure was accessed directly in-person or remotely.

Conclusion

Despite the challenges presented by Covid-19, the war in Ukraine and the resulting increase in fuel, travel and transport costs, 28 Transnational Access projects were implemented during the Eurofleets+ project despite complex logistical challenges in what was a rather turbulent period in our history. Unfortunately, three TA scheduled cruises were cancelled as a result of Covid-19 (2) and the war in Ukraine (1). These cancellations enabled the funding of other highly-ranked proposals to be realised instead. This resulted in 268 days' access to research vessels and marine equipment for 291 researchers from 33 countries. Much of the results and impact of the research cruises are still being analysed and additional post-doctorate positions have been created in some cases in order to carry out the post-cruise analysis of the acquired data-sets. Recognition must be given to all of the infrastructure operators, researchers, vessel crews and marine equipment technicians as it is thanks to their flexibility and dedication that the projects were implemented in particular during the Covid years.

Annex 1 – Infrastructures used to Implement Eurofleets+ Transnational Access

 <p>AUV Hugin, Sweden</p>	 <p>RV AEGAE0, Greece</p>	 <p>RV Celtic Explorer, Ireland</p>	 <p>RV Pelagia, Netherlands</p>
 <p>RV Dana, Denmark</p>	 <p>RV G.O. SARS, Norway</p>	 <p>ROV AEGIR 6000, Norway</p>	 <p>RV Tubitak Marmara, Turkey</p>
 <p>RV Socib, Spain</p>	 <p>RV Belgica, Belgium</p>	 <p>AUV VLIZ, Belgium</p>	 <p>RV Aranda, Finland</p>
 <p>RV Arni Friedrickson, Iceland</p>	 <p>RV Sanna, Greenland</p>	 <p>RV Atlantic Explorer, Bermuda</p>	 <p>RV Ramon Margalef, Spain</p>
 <p>RV Sarmiento De Gamboa, Spain</p>	 <p>RV Tangaroa, New Zealand</p>	 <p>ROV Max Rover, Greece</p>	 <p>RV Laura Bassi, Italy</p>