tara EUROPA

TREC
Traversing European Coastlines

Press kit

April 2023 - September 2024

Fondation taraocéan
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EMBL

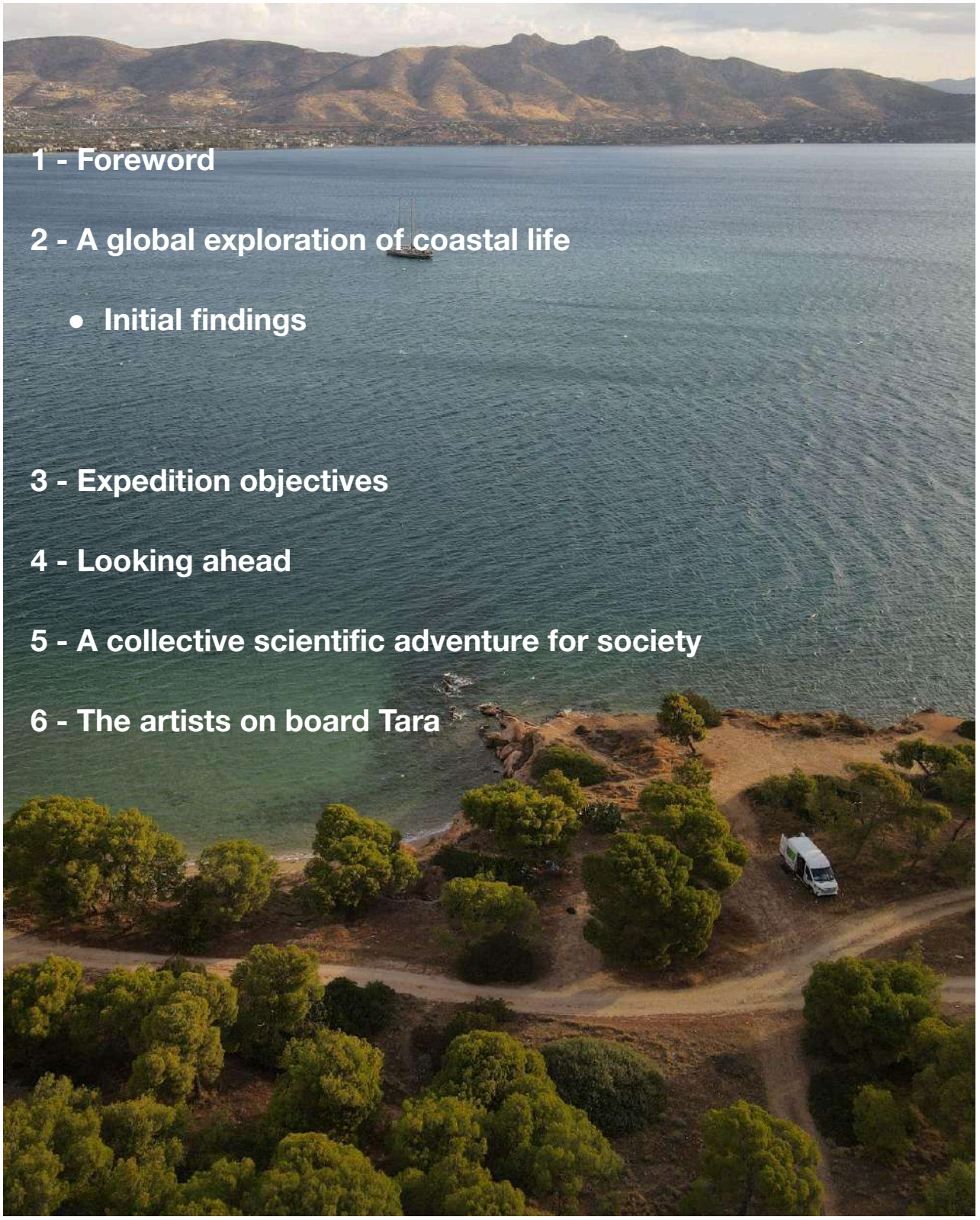
EMBRC
EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

Return of the schooner Tara and the EMBL mobile laboratory after an unprecedented 18-month land-sea expedition.

Starting on April 2, 2023, the TREC (TRaversing European Coastlines) scientific expedition is a global exploration of life in water, sediment, soil and air along Europe's coasts. Its aim: to understand how coastal ecosystems function and adapt to natural changes and the impact of human activities. While the scientists on Tara were sampling at sea, the mobile laboratories of the EMBL (European Molecular Biology Laboratory) were taking samples on land to study the entire land-sea continuum.

The Tara Europa expedition is part of the TREC - Traversing European Coastlines program, designed by EMBL, the Tara Europa consortium, the Tara Ocean Foundation and EMBRC, in collaboration with over **90 scientific institutions.**

Summary



Foreword

We live in an interconnected world

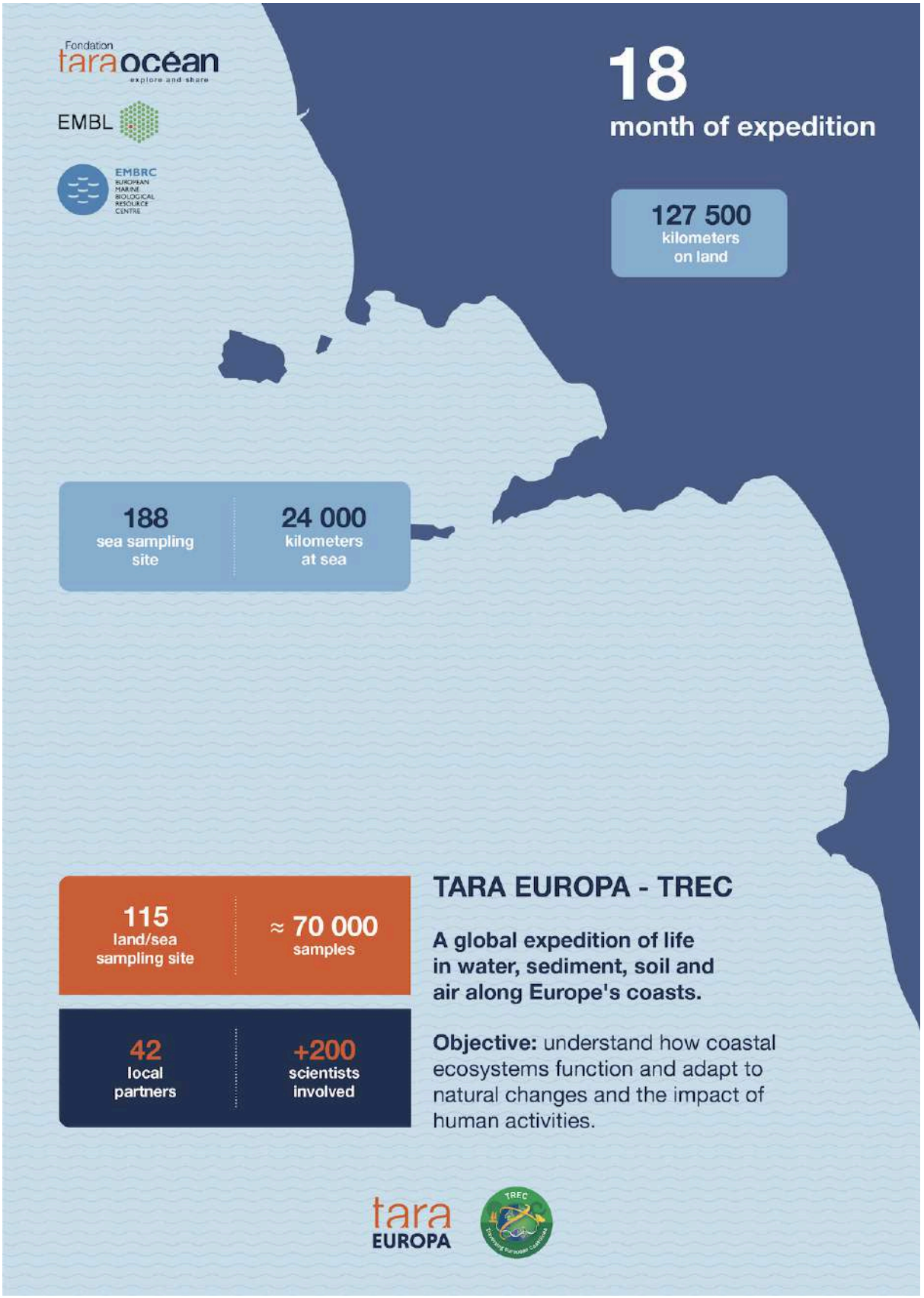
Our planet is facing a global crisis due to the acceleration of global changes caused by human activities. From greenhouse gases and overuse of antibiotics to household, agricultural and industrial waste, human activities are affecting our planet in many different ways. Changes in the Earth's climate system, the degradation of ecosystems, or the loss of organisms' ability to adapt to environmental change are major risks for humanity. Understanding the complex web of interactions between organisms and their environment is crucial to human life on our planet. Over 40% of the human population lives in coastal areas. Although they are home to a large proportion of the world's biodiversity, coastal areas have suffered from accelerated artificialization, increased tourism, overexploitation of natural resources and the growing presence of pollutants, which accumulate along rivers and valleys.

The TREC (Traversing European Coastlines) expedition, which included Tara Europa, studied an **ecotone** (ecological transition zone between two or more ecosystems) **under pressure**. **A truly extraordinary scientific voyage along the coasts of Europe, TREC left on April 2, 2023, to explore biodiversity as a whole and certain key coastal species and habitats, as well as the molecular and cellular mechanisms that enable living organisms to adapt and evolve in the face of environmental and societal change.**

"The data, knowledge and scientific networks that have been created through the TREC - Traversing European Coastlines- expedition will undoubtedly lead to innovative ideas through this voyage of discovery, and will help develop new strategies to protect coastal environments from global challenges such as climate change, pollution and biodiversity depletion." **Professor Edith Heard** , Director General of EMBL (European Molecular Biology Laboratory)

"It's an enormous satisfaction for the entire Tara Ocean Foundation team to bring its 13th expedition, Tara Europa, to a close. It was an expedition as close as possible to the territories, as close as possible to us, to try and put numbers on our direct impact on the living beings of our European coastlines. To describe this marriage between land and sea is to bring us all closer to the Ocean, and to do it with a hundred laboratories over such a vast territory is an achievement. We need to redouble our efforts to make our companies aware of the obvious." **Romain Troublé,** Director of the Tara Ocean Foundation

"Researchers at EMBRC's network of marine stations and institutes have been dedicated to studying ocean biodiversity in depth for several decades. We are delighted to put our knowledge at the service of this important expedition, which will enable us to better understand the impact of human activities on marine life and make new scientific discoveries. It's thanks to large-scale expeditions like TREC that we'll be able to better understand how natural ecosystems function. This knowledge is essential if we are to protect our oceans and ensure a sustainable future for generations to come." **Nicolas Pade**, Executive Director, EMBRC.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EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE
18
month of expedition
127 500
kilometers on land
188
sea sampling site
24 000
kilometers at sea
115
land/sea sampling site
≈ 70 000
samples
42
local partners
+200
scientists involved
TARA EUROPA - TREC
A global expedition of life in water, sediment, soil and air along Europe's coasts.
Objective: understand how coastal ecosystems function and adapt to natural changes and the impact of human activities.
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LEGEND
Common stopovers TREC / Tara EUROPA
Port calls Tara EUROPA
Sampling Coastal Sites
2023
2024
NORWAY
Bergen
SWEDEN
Stockholm
Kristineberg
Tallinn
ESTONIA
LATVIA
Riga
Aarhus
Edinbourg
NORTH SEA
BALTIC SEA
Sopot
Bremerhaven
Amsterdam
Galway
POLAND
GERMANY
CELTIC SEA
Ostende
BELGIUM
ENGLISH CHANNEL
Roscoff
FRANCE
LORIENT
ATLANTIC OCEAN
La Rochelle
Lyon
Venice
Marseille
Nice
Ancona
Bilbao
ITALY
Kotor
Barcelona
Porto
Naples
Thessaloniki
SPAIN
GREECE
PORTUGAL
Athens
Málaga
MEDITERRANEAN SEA
The new Tara Europa expedition is part of a larger research programme, TREC (TRaversing European Coastlines), led by the European Molecular Biology Laboratory (EMBL). Its objective is to study the land-sea interface, where biodiversity meets numerous pollutions. During this expedition, sampling will take place simultaneously at sea, on board the schooner Tara, and on land thanks to EMBL's mobile laboratories.
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TREC
Traversing European Coastlines

A global exploration of life on Europe's coasts

Throughout the expedition, information was gathered on the diversity of living organisms, particularly those that are invisible, both on land and at sea along the European coastline. **TREC covered all taxonomic scales** (viruses, bacteria, protists, algae, plants and animals), exploring organisms in communities and on a population scale, the molecular basis of their interactions, and their contribution to shaping their environment. Data on environmental parameters were collected in a systematic and standardized way. In all, over 150 standardized measurement protocols were carried out on each of the 115 land-sea transects studied from Finland to Greece.

Researchers examined a wide range of **anthropogenic and natural factors, such as the presence of pollutants, antibiotics, pesticides or hormones, but also temperature, pH, salinity, oxygen levels and certain geophysical parameters.**

The truly innovative aspect of the expedition is the **study of the interconnectivity of organisms - with each other and with environmental factors - in their natural environment rather than in the controlled conditions of a laboratory.**

Biological samples are fragile: as soon as a drop of water or a fragment of soil is removed from the natural environment, the organisms it contains begin to transform. To maximize the integrity of organisms and study them in the context of their natural environment, EMBL has brought the laboratory to the samples, rather than the samples to the laboratory. The equipment and technologies that form part of EMBL's advanced mobile services have enabled scientists to conduct cutting-edge subcellular research in close proximity to the field. Mobile services include state-of-the-art light microscopy, sample preparation for (cryo)electron microscopy and single-cell phenogenomics. In addition, innovative tools for environmental measurements from soil, air, sediment and water samples will be part of the standard equipment.

Initial findings

“By systematically measuring the entire spectrum of living organisms - from molecules to organisms, from viruses to animals - in environments as diverse as water, soil and air, yet all intertwined along Europe's coasts, I believe that TREC lays the foundations for 'planetary biology'. This is the science we're all dreaming of, and which, in a few decades' time, will enable us to understand how ecosystems self-organize, function and talk to each other, so that together they form a rich, living planet. This knowledge will also be the prerequisite for our (sur)life within the biosphere. EMBL and the Tara Océan Foundation were just what we needed to start probing the frontiers of planetary biology! ”

Dr Colomban De Vargas, CNRS and Sorbonne University Research Director, Tara Europa Scientific Director

- **Unique homogeneous sampling across the environmental gradients of Europe's coasts**

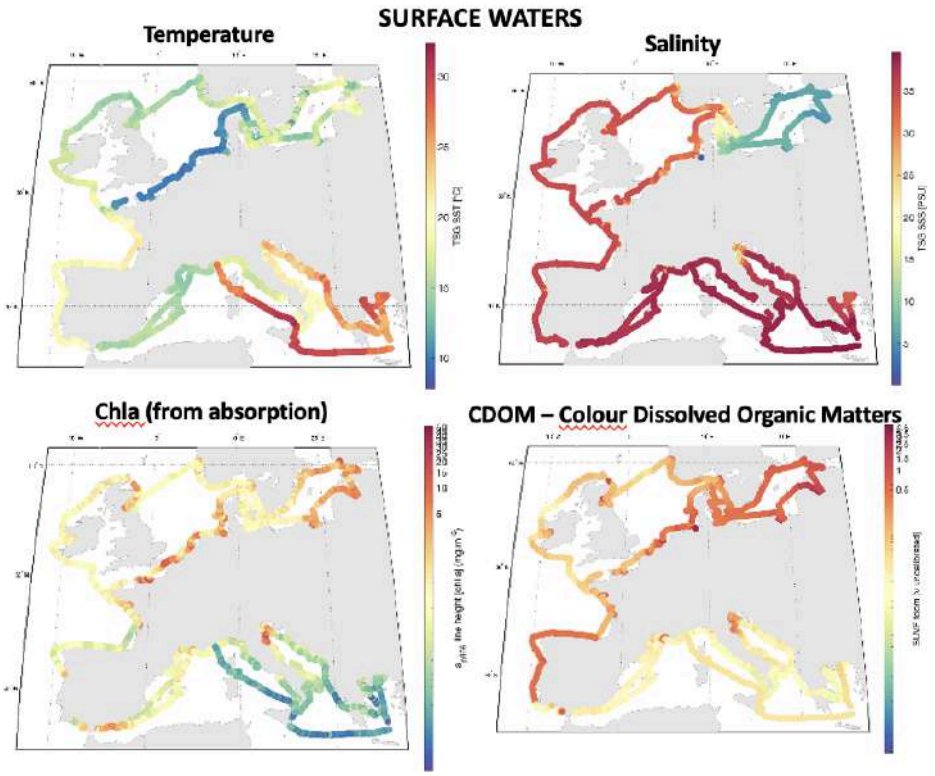
Sampling on the scale of Europe's coasts means sampling along environmental gradients that are exceptional in their variety and amplitude. A series of instruments has been installed on board Tara to continuously **measure fundamental ocean parameters** along the way, including temperature, salinity, fluorescence of organic matter, phytoplankton (optical properties and microscopic images), turbidity, as well as light intensity and color.

Preliminary data show the astonishing variety of coastal waters sampled, ranging from 5°C along the EU's northern coast to 35°C in Greece, from the brackish waters of the Baltic Sea to the high-salinity waters of the Mediterranean, and from the turbid waters at river mouths to the extremely clear waters off the Mediterranean.

In addition to measuring the intensity and color of light entering and leaving the ocean, using **sensors similar to those fitted to the next generation of satellites** (e.g. NASA PACE), we also measured the **quantity and quality of dissolved organic matter, which forms the largest, most complex and least understood reactive carbon reservoir on Earth.**

This unprecedented dataset will not only enable biological data to be placed in their environmental context, but also link the complexity of ecosystems, measured in situ, to ocean color data measured from space.

This will provide new insights into carbon fluxes along Europe's coasts, and could be used to develop Artificial Intelligence tools to monitor the biological health of the ocean from space.



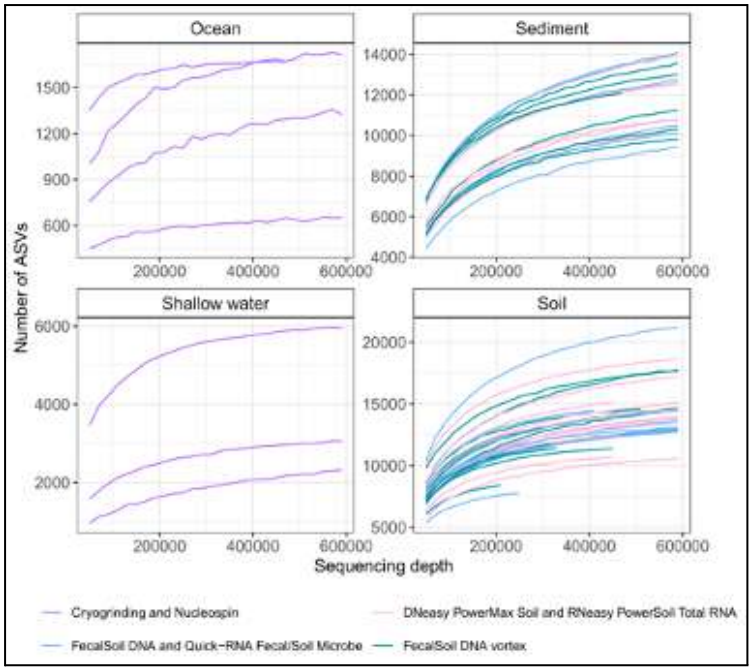
Key environmental parameters (A. Temperature; B. Salinity; C. Chlorophyll a; D. Colored dissolved organic matter) measured by instruments onboard Tara, continuously capturing surface water throughout Tara Europa's journey. Emmanuel Boss et al, University of Maine. Preliminary raw data.

- **Deciphering the genomes and genes that shape coastal ecosystems**

Tens of thousands of water, sediment, soil and air samples collected along the 115 land-sea gradients explored from Finland to Greece will be sequenced at the Genoscope (CEA, France) to understand their genome content (metagenomics), expressed genes (metatranscriptomics) and species (metabarcoding). Preliminary analyses of genetic diversity along land-sea gradients demonstrate the **high quality of the samples collected, and suggest a sharp decrease in diversity/richness from soils, to sediments, to shallow waters, to coastal waters and air.**

Initial data indicate that we are likely to discover over 1,000 microbial species at each sampling site.

Beyond the discovery of new species and genes, the final dataset from extremely divergent biomes (water, soil, sediment, air) interconnected in a mosaic of different natural and anthropogenic conditions, will provide a **unique baseline for understanding how life as a whole functions, adapts and evolves** not only within ecosystems, but also across ecosystems, sharing genes and species.



Preliminary analysis of 'species' richness (genetic marker or metabarcode, X Axis), as a function of sequencing depth (number of sequences obtained, Y Axis), for samples of coastal water, beach water, marine sediments and soil collected on a Land-Sea transect in Rostock, Germany. Genoscope, Evry, CEA.

- **Automatic imaging of organisms and novel microscopy methods to peer inside cells.**

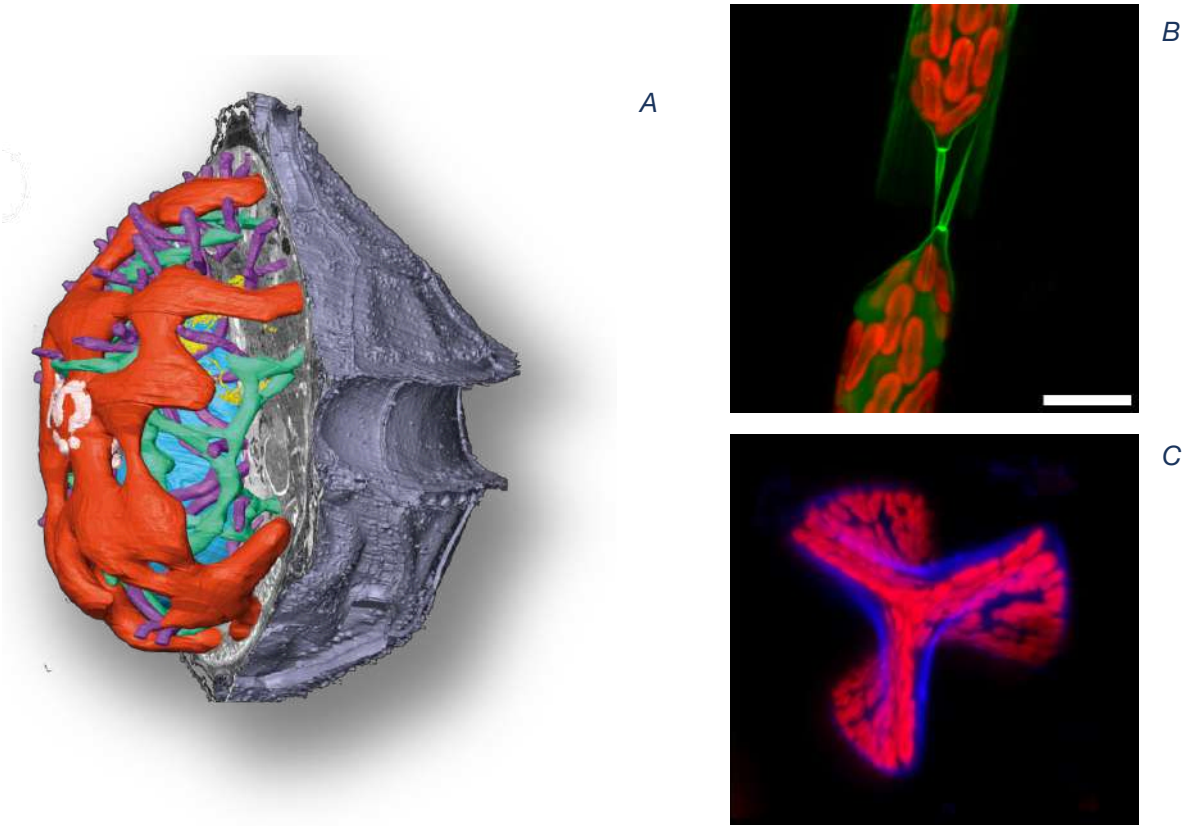
Automatic imaging systems on board (Flowcam, FlowCytoBot) or in the laboratory (ZooScan) have already made it possible to obtain **the largest quantitative and homogeneous dataset of images (over 24 million) of marine micro-organisms**, on the scale of European coastal ecosystems.

Preliminary analyses of the morphological diversity of individual cells and organisms, carried out using the most sophisticated imaging technologies available on EMBL's Advanced Mobile Laboratory (AML) , suggest the emergence of a whole new discipline, "environmental structural biology", offering an unprecedented view of the inside of cells and organisms.

It is highly likely that this will lead to the discovery of new fundamental components within cells, known as organelles, which are the functional units of life and can help us to **better understand the evolution of biodiversity in the ocean,** but also on the continents.

The use of artificial intelligence for the physical isolation of target cells accelerates our ability to study the vast morphological complexity of plankton, in particular to **study key organisms in a holistic way, combining imaging, genetic information, behavior**, and even bringing them back alive to the laboratory for further study.

The cutting-edge molecular and cellular biology technologies brought to the coasts by EMBL enable us to study **how species interact with each other, for example through viral infection or symbiosis.** While it is now obvious to list the species and genes present in an ecosystem, the complex network of interactions between species is poorly understood, even though it plays a decisive role both in the adaptation of biodiversity and in the functioning of ecosystems. The first images from TREC samples, of microbiomes associated with eukaryotic organisms, viruses in soils, and cell-cell interactions, suggest that **our understanding of the web of life is set to progress considerably.**



A. Cryo-electron microscopy makes it possible to observe in detail and reconstruct in 3D the intracellular structures and functions of key plankton cells - here a dinoflagellate (credits: Karel Mocaer, Yannick Schwab, EMBL.

B. and C. Phytoplankton cells imaged with a confocal microscope - different types of markers reveal organelles and processes in progress. (Credits: Thomas Beavis, Flora Vincent, Tina Wiegand, EMBL.)

- **An exploration of the evolution of European marine coastal ecosystems since the early 19th century.**

Several related projects, notably funded by the European Union, complement the large-scale spatial analyses carried out by EMBL's mobile laboratories and on Tara. These include the BIOcean5D (https://biocean5d.org/), co and BlueRemediomics (https://blueremediomics.eu/) projects.

In particular, the researchers succeeded in **taking sediment cores about 1m long from 15 European coastal sites subjected to various impacts over the course of the history of local human societies**: agriculture, industrial and urban development, modifications to the coastline, development of aquaculture, and so on.

Sediment dating has already shown that the 15 cores cover the Anthropocene period (from the early 19th century to the present day), with periods when anthropogenic impacts may have led to irreversible changes in biodiversity.

The sequencing of ancient sedimentary DNA (paleomics) and the analysis of other complementary biological and chemical data (organic and inorganic contaminants, organic carbon, genomics of resuscitated plankton strains, imaging) along the cores, will enable us to assess: (i) changes in biodiversity over time, as a function of anthropogenic factors; (ii) the emergence of new functional biodiversity traits following ecosystem variations; (iii) the long-term dynamics of invasive species; (iv) the resilience of ecosystems following various impacts of human activity.

This long-term paleoecological perspective will be compared with current ecological gradient analyses carried out by Tara and EMBL's rolling laboratories, providing an **unprecedented pan-European spatio-temporal vision of the dynamics of life and ecosystems.**

Deployment of the Interface corer for sampling sediment cores to study variations in biodiversity since the beginning of the Industrial Revolution. Raffaele Siano et al, IFREMER.

Expedition objectives

TREC brings together researchers from all over Europe to measure life on taxonomic (from viruses to animals), biological (from molecules to cells) and environmental scales, in a mosaic of ecosystems along the European coast.

TREC will provide a much more comprehensive and in-depth understanding of how these ecosystems respond to natural and anthropogenic changes. This new knowledge will help provide our societies and governments with the scientific basis to **better understand and manage societal issues ranging from the effects of multiple pollution to climate disruption on these key ecosystems.**

During the TREC expedition, researchers from the European Molecular Biology Laboratory (EMBL), the Tara Europa consortium, the Tara Ocean Foundation and the European Marine Biological Resource Center (EMBRC-ERIC) took part in the systematic and homogeneous collection of soil, sediment, aerosol and water samples, as well as selected model organisms, while measuring contextual environmental parameters along Europe's coasts.

Three major objectives

1. **Study coastal biodiversity and the complexity of life on land, at sea and in the air, to understand the major functions and interactions of living organisms within and between these ecosystems.**

Since April 2023, researchers have been surveying the European coastline to **map and inventory the species present and their interactions along natural and anthropogenic environmental gradients and across national borders.**

During the TREC expedition, teams :

- applied more than **200 of the most advanced protocols and technologies** for a **unique and comprehensive exploration of ecosystems**, particularly at the molecular and cellular levels;
- collected over 70,000 samples that will reveal the unknown part of coastal biodiversity and new biological functions on land, at sea and in the interactions between these highly divergent environments.

This massive effort will also make it possible to :

- provide a **homogeneous biological, (bio)chemical and physical database unprecedented on a European scale**. Institutes across Europe will be able to use the data collected for future comparative studies. In addition to being analyzed by TREC partners and collaborators, all data produced will be freely accessible to the international scientific community.
- stimulate the development of future technologies for assessing ecosystem health and bioremediation.

*The TREC expedition aims to **complete the inventory of marine microscopic biodiversity (marine microbiomes)**. This fresco of life, initiated in 2009 with the Tara Oceans expedition and completed during subsequent expeditions, notably the Microbiomes Mission, has focused mainly on the High Seas. TREC will complete the picture by providing invaluable data on coastal marine ecosystems.*

2. Understand how the health of the planet and human health are interconnected

The second scientific objective of the expedition is to **better understand the impact of human activities on biodiversity and ecosystems.** Scientists are now analyzing samples taken from soil, sediment and water for various chemical compounds, including **pharmaceuticals, pesticides and metals**. The aim is to measure pollutant concentrations all along the European coast, and to **discover the many unknown products formed when pollutants are degraded or transformed**, notably by microbial metabolisms. They will study the ecotoxicology of these compounds and look for microbes capable of biodegrading pollutants. The TREC expedition will enable :

- discover the inextricable and complex links between **global health and human health** (One Health) at the interface between land and sea;
- contribute to understanding the **relative and synergistic impacts of pollution and global climate change** on biodiversity and the functions of coastal ecosystems;
- help understand **major societal challenges such as antibiotic resistance** by exploring how the genes involved can spread between organisms and across ecosystems.

3. Promoting collaboration, scientific training and public engagement

This pan-European expedition :

- creates value for the scientific community and society by bringing together more than **150 teams from a variety of disciplines, belonging to some 100 institutions in 21 European countries;**
- provided advanced knowledge and technologies for the benefit of the scientific community in Europe and worldwide;
- engaged the general public in debates and discussions to raise awareness of the role of science and fundamental knowledge in society;
- inspired the next generation of scientists by raising awareness among students and teachers of the importance of understanding life on our planet.

During the TREC expedition, **the schooner Tara sampled in parallel with EMBL's mobile laboratory trucks deployed on land**. Each sampling point was determined in collaboration between the teams. At the 'service sites', the scientists were joined by researchers from the local biological marine stations to bring the samples collected on board Tara directly ashore for analysis and rapid storage in EMBL's Advanced Mobile Laboratory (AML).

At the heart of TREC is collaboration with numerous national and international partners, in particular with the **42 European marine stations** from Portugal to Estonia and from Finland to Greece. Setting up this unique sampling strategy required meticulous planning and detailed communication between the various scientific disciplines and institutions.

Outlook

Scientists will now analyze all the data to **understand how organisms and ecosystems adapt to environmental changes at the molecular and cellular level.** At the same time, the information gathered during this expedition will be used to **build a reference database** (funded with support from the European BlueRemediomics project (https://blueremediomics.eu/) that will enable changes in coastal ecosystems to be studied for years to come.

Individual scientific projects already range from assessing the interactions of microbial communities between land and sea, to understanding the adaptation of certain species to different conditions and environmental changes, through the study of symbioses, which seem to be at the heart of the evolution of living organisms.

In the future, the teams will continue to study the samples collected to discover the many secrets they can reveal about biodiversity and coastal ecosystems. They will also work with the wider scientific community in Europe and beyond to determine how the approaches of this extraordinary expedition can be applied to other ecosystems, such as lakes and rivers.

TREC brought **some of the most advanced technologies available to life scientists into the field. The program has enabled scientists to address entirely new questions about fundamental biological processes in a way that has never been done before**. In collaboration with partner organizations and institutions, scientists offered scientific workshops on a range of topics and techniques, including hands-on training on mobile laboratory equipment. In this way, technologies and methods were made available to a wider scientific community. TREC's scientific efforts, as well as data collection and analysis, also support other European projects that will contribute to a better scientific, societal and political understanding of the importance of maintaining the biological health of our seas and coasts. One example is the major interdisciplinary BIOcean5D project funded by the European Commission (www.biocean5D.org).

A collective scientific adventure for society

- **Making science accessible to the European public**

Civil society is essential if we are to bring about profound social change. For this reason, awareness-raising stopovers were organized along the TREC route and beyond, during which various activities were organized to engage the general public and schoolchildren. Citizens were able to listen to scientists or explore for themselves, using scientific tools, the links between land and sea, humans and the planet. Teachers and educators were able to access training and resources to engage and inspire the next generation of scientists. In this way, **TREC stimulated public debate on the role science plays in society and inspired the next generation of scientists. At the same time, the teams raised public awareness of the important role each of us has in preserving the health of our planet, our Ocean and ourselves.**

- **Nourishing European policies with scientific discoveries**

Beyond plastic pollution, which has been the focus of attention for over a decade, **man-made chemical pollution of rivers and coasts must be at the heart of our concerns.**

The Europe-wide scientific collaboration represented by TREC underlines the vital importance of current and future European legislation on water and coastal ecosystems. Through this international, multi-disciplinary scientific approach, the TREC expedition aims to provide knowledge and expertise that will help clarify priorities for future European Union (EU) “Green Deal” investments to **ensure healthy, functioning ecosystems**, and work towards the urgent goal of **improving Europe's overall health.**

The artists of the Tara Europa expedition

Raising awareness through Art: To explore and share, each expedition of the Tara schooner is a cross-fertilization between artists, scientists and sailors. The Tara Ocean Foundation is not only the bearer of scientific knowledge through its expeditions, it is also a place of artistic residence. During this expedition, **12 artists** took part, 6 winners of the call for residencies and 6 other invited artists.

Robertina Sebjanic, Visual artist - *From Aarhus to Riga.* Robertina Šebjanič is an artist-researcher whose work explores the biological, chemical, (geo)political and cultural realities of aquatic environments and the impacts of humans on the other organisms that live there. Her projects are a call for the development of new collective strategies based on empathy for a better recognition of non-human entities. In her analysis of the Anthropocene and its theoretical field, the artist uses the terms “aquatocene” and “aquaforming” to describe human impacts on the marine environment. His work has received numerous awards and nominations, including the Prix Ars Electronica, the Starts Prize, Falling Walls and RE: Humanism.

Cécile Fouillade, Artist sculptor - *From Bergen to Galway.* Passionate about the Far North, Cécile Fouillade, whose artist name is Siqou, attempts to recreate a cold, delicate and powerful porcelain universe. She seeks to find all the asperities of this incredible material in the different textures offered by the landscapes she observes during her artistic residencies, such as those of Greenland, Norway and Iceland, always aboard boats. A ceramist working in Paris, she recently won the Prix de la Jeune Création Métiers d'Art Atelier d'Art de France 2022.

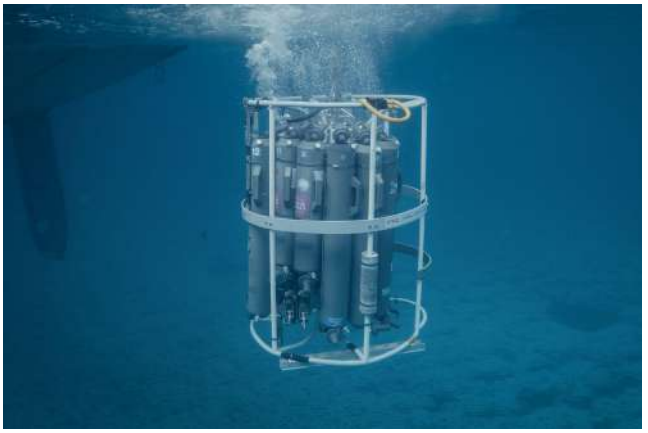
Renata Padovan, Visual Artist - *From Galway to Bilbao.* Renata Padovan is a Brazilian artist who lives and works in São Paulo, Brazil. She holds a BA in Social Communications from FAAP São Paulo and an MFA from Chelsea College of Art, London. Since 2019, she has been a member of RETA (Réseau Transdisciplinaire Amazonien). Her work is inspired by research into environmental degradation and its socio-cultural effects. She uses a variety of techniques; media are chosen according to the concept of each project. Her work has been exhibited in Brazil and in various institutions, galleries and festivals around the world.

Enrique Ramirez, Visual artist, sound artist and sculptor. *From Malaga to Barcelona.* Enrique Ramírez was born in Santiago (Chile) in 1979. He lives and works in Paris (France) and Santiago (Chile). He studied popular music and cinema in Chile before joining the Studio National des Arts Contemporains-Le Fresnoy (Tourcoing, France) in 2007. Combining photography, video, music and installation, his political and poetic work questions the meaning and power of the image. His work is haunted by the sea, a sea he traveled extensively with his father, a sailmaker under the Pinochet dictatorship.

Arianna Pace, Visual Artist - *From Naple to Ancone*
Arianna est née à Pesaro, en Italie, en 1995. En 2020, elle obtient son diplôme de l'Académie des Beaux-Arts d'Urbino (Italie). Elle a participé à diverses résidences artistiques, expositions et projets en Italie et à l'étranger. Elle a reçu des prix et des mentions spéciales lors de remises de récompenses nationales et internationales. Ses recherches portent sur cet échantillon de paysage qui n'apparaît pas immédiatement à l'observateur. Elle en prend soin afin de le faire survivre. Elle présente un paysage, inspiré par ce témoignage.

Laure Winants, Visual Artist - *De Venise à Patras*

Laure Winants is an artist-researcher based between Paris and Brussels. Her research highlights the ways in which living organisms are highly interdependent on each other and their environments, and the importance of giving a voice to non-human entities. She works with sensitive materials, creating active works that react to their environment: light, weather, temperature, humidity. During polar missions, Laure works directly in the elements and joins the scientific expedition. The experiments are numerous: capturing the composition of light, capturing the acoustic inflexions of icebergs, printing the chemical composition of water.



About us

Tara Ocean Foundation

The Tara Ocean Foundation is France's first charitable foundation dedicated to the ocean. For 21 years, it has been leading a revolution to preserve life, convinced that the Ocean is essential to the balance of our planet. Exploring the Ocean and sharing scientific discoveries to raise collective awareness is at the heart of the foundation's mission.

The foundation leads scientific expeditions, in partnership with leading research laboratories, to study marine biodiversity and to observe and anticipate the impacts of climate change and pollution. It raises awareness among citizens, from the younger generation to political decision-makers. Thanks to its status as a UN Special Observer, the Foundation plays an active role in international ocean governance.

Exploring, sharing and protecting this living Ocean is more vital than ever. Together, let's defend life. Let's protect the Ocean. Discover the foundation at https://fondationtaraocean.org/ and on video.

European Molecular Biology Laboratory (EMBL)

The European Molecular Biology Laboratory (EMBL) is Europe's laboratory for the life sciences. We provide leadership and coordination for life sciences across Europe, and our world-class basic research aims to find collaborative, interdisciplinary solutions to some of society's greatest challenges. We train students and scientists, foster the development of new technologies and methods in the life sciences, and provide state-of-the-art research infrastructure for a wide range of experimental and data services. EMBL is an intergovernmental organization with 29 member states, one associate member and one prospective member. At our six sites in Barcelona, Grenoble, Hamburg, Heidelberg, Hinxton near Cambridge and Rome, we seek to better understand life in its natural context, from molecules to ecosystems. https://www.embl.org/

European Marine Biological Resource Centre (EMBRC)

EMBRC (European Marine Biological Resource Centre) is a European research infrastructure specialized in marine biology and ecology. Its aim is to advance science and knowledge of marine biodiversity and ecosystems, in support of research and the development of a sustainable blue economy. Present in 10 European countries, through a network of over 80 marine stations and institutes, EMBRC provides access to cutting-edge services and technologies that enable academic and industrial researchers to develop their projects. EMBRC has created EMO BON (European Marine Omics Biodiversity Observation Network), the first genomic biodiversity observatory in Europe, to strengthen global ocean observation systems using environmental DNA techniques. Supporting education, the organization encourages training in marine sciences for future generations, through its Marine Training e-learning platform. Faced with environmental challenges, EMBRC contributes to the understanding of ocean biodiversity and its evolution, and supports the development of science-based policies. The organization is part of the ESFRI (European Strategic Forum for Research Infrastructures) roadmap and has the legal status of ERIC (European Research Infrastructure Consortium) awarded by the European Commission. embrc.eu, Twitter, LinkedIn, and Youtube.

BIOCean5D

A European, multidisciplinary project exploring marine life and how it changes with space, time and human impact. BIOcean5D is a powerful aggregator, bridging molecular to organismal biology, theoretical ecology and econometrics, and marine complex systems to social sciences. Our approach enables us to consistently measure and interpret marine biodiversity and its interactions and functions, from viruses to whales, molecules to species. We're building an unprecedented set of samples, integrating existing samples and data with new sets collected from across the European coastline and data archives. And we're using cutting-edge technologies, including eDNA/RNA sequencing, automated imaging, acoustics and remote sensing, massive computing power, artificial intelligence, and complex-system modelling. Combined, this will give us a detailed picture of both taxonomic and functional marine biodiversity, and how they change across the 5 dimensions of space, time, and human impact. Learn more on: https://biocean5d.org/

Blue Remediomics

The Blue Remediomics project aims to develop new tools and approaches for exploring marine microbiome data, bringing together an international consortium of experts working to discover and produce high-value, sustainable products, processes and services based on the marine microbiome. BlueRemediomics systematically catalogs marine microbiome data and marine culture collections to facilitate the development of industrial processes that reduce waste, increase the reuse of natural products and by-products, and improve aquaculture processes. The project also aims to ensure equitable access to and sharing of the benefits derived from any new products, such as new medicines or cosmetics. The marine microbiome is one of the fastest-growing segments of the blue bioeconomy, and its study is vital to the discovery, understanding, protection and use of our ocean resources. Learn more on: https://blueremediomics.eu/

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www.fondationtaraocean.org

TREC: the first scientific expedition to understand how natural and human factors, such as climate change and pollution, influence European coastal ecosystems.

Fondation tara océan explore and share

EMBRC EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

EMBL

A VARIETY OF ECOSYSTEMS

Coastal ecosystems vary greatly!
That's why we are focusing
on four specific types.

urban and port areas

estuaries

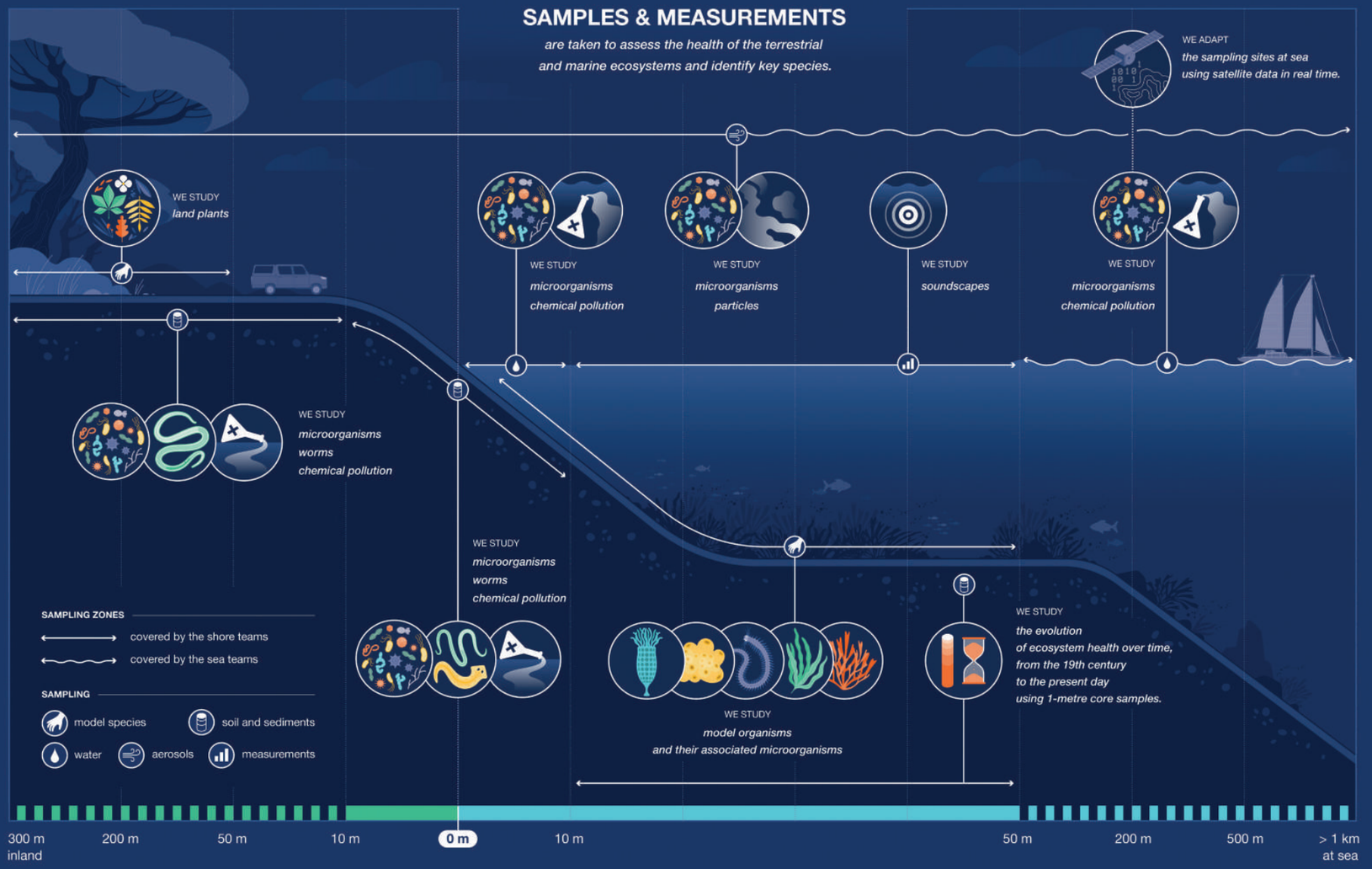
agricultural areas

pristine nature

These are home to much of the world's biodiversity and essential for both the balance of the major natural systems and human societies.

SAMPLES & MEASUREMENTS

are taken to assess the health of the terrestrial and marine ecosystems and identify key species.



MOBILE LABORATORIES

A specially equipped trailer

Enables the thorough analysis of the samples as closely as possible to their point of collection, and provides training for local scientists on cutting-edge equipment.

A truck

Offers a platform to standardise sample preparation before they are dispatched to partner laboratories for analysis.

Sampling vehicles

Carry equipment required for sampling in the field.

ON LAND

A FLOATING LABORATORY

The scientific schooner *Tara* of the Tara Ocean Foundation carries **3 laboratories**: a wet laboratory on deck, and two dry laboratories below decks.

AT SEA

studio.v2

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