EMBRC EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

Fondation tara océan explore and share

EMBL

Traversing European Coastlines

A scientific expedition to understand how natural and human-made factors like climate change and pollution impact coastal ecosystems

European Molecular Biology Laboratory

We live in an interconnected world

While that phrase might, at first glance, conjure up thoughts of our global digital connectivity or transportation networks that take us to every corner of the world, it applies, first and foremost, to our natural world.

The ecosystems on land and at sea don't exist in isolation. They, and the organisms within them, influence each other, impact the overall health of our planet, and underpin the evolution of life on Earth.

Coastal regions are key functional ecosystems on which humans depend for their livelihoods and well-being - 40% of Europe's population lives within a coastal region. For centuries, ecologists, marine biologists, evolutionary and developmental biologists, and many others have studied organisms and the ecosystems they live in. The knowledge they created has already driven debate and decisions necessary to protect natural habitats.

Scientists now have at hand the most advanced molecular and cell biology technologies that make it possible to study – in the field – the mechanisms of life on Earth at a scale and level of detail that was not possible before. From genomics and metabolomics to imaging and artificial intelligence – we can generate and integrate big data from the smallest microbes through to animals and plants in different ecosystems on land, in the water, and at their interface.

"The TREC expedition will provide a richer and deeper understanding of how ecosystems respond to natural and human-made challenges. As a result of scientific and technological advances in recent years, we now have the tools and knowledge needed to document, examine, and probe the molecular and cellular states of life in our coastal areas in the field, in real time, across national borders, and at an unprecedented scale."

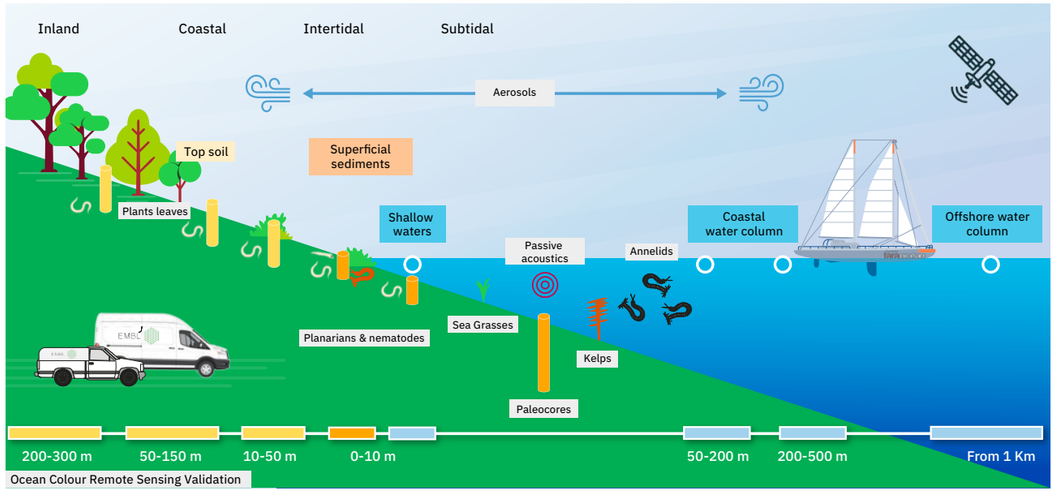
Professor Edith Heard FRS, Director General, European Molecular Biology Laboratory (EMBL)

"Our seas and coasts host an extremely rich diversity of life and play critical roles in the stability and sustainability of wider ecosystems. The TREC expedition is the first time researchers from across Europe study life at all biological scales, from molecules to communities, along the entire European coast. This will produce new knowledge and discoveries that will help to provide our societies, governments, and regulatory agencies with the ability to best predict the possible effects of environmental changes and impacts."

Romain Troublé, Director General, Tara Ocean Foundation

TREC (Traversing European Coastlines) is an international, highly collaborative scientific expedition led by Europe's life sciences laboratory EMBL that addresses fundamental biological questions at the core of environmental and societal challenges. TREC explores the interactions within and between the two major ecosystems on our planet: ocean and land. It brings molecular sciences to environmental research in a Europe-wide project at an unprecedented scale, to better understand how organisms – from viruses to animals – respond to natural and human-made environmental changes.

An important new aspect of this scientific endeavour is combining land- and sea-based expeditions along the entire European coast. At each point where the EMBL team with the mobile laboratory and collaborators samples soil, sediments, and shallow water, the schooner *Tara* samples the associated marine ecosystems – on the same day and in the immediate vicinity.



The TREC expedition explores the interactions between the two major and highly divergent ecosystems on our planet: land and sea. By bringing molecular and cellular sciences to environmental research in a Europe-wide project, it enables the study of how organisms respond to natural and human-made environmental factors across different scales.

A mission for science and society

TREC brings together researchers across borders and scientific disciplines with a common goal of studying life in our coastal regions at all scales. During the TREC expedition, researchers from the European Molecular Biology Laboratory (EMBL) and the Tara OceanS consortium, together with the Tara Ocean Foundation, the European Marine Biological Resource Centre (EMBRC-ERIC), and **more than 150 research teams from over 70 institutions in 21 European countries**, will collect and analyse soil, sediment, aerosol, and water samples, as well as selected model organisms and environmental data along European coastlines. In doing so, they are pursuing three major goals with benefits for science and society.

1. Unveil the invisible biodiversity on land and at sea, and understand the effects of environmental changes on the interactions within and between ecosystems

Through the TREC expedition, we will:

- apply some of the most advanced biotechnologies for a unique, holistic exploration of ecosystems on the molecular and cellular level
- unveil new biodiversity and biological functions on land, at sea, and in the space where the two meet
- study these organisms, which are at the heart of healthy ecosystems
- use the knowledge acquired to drive the development of future technologies to assess ecosystem health and bioremediation

"During Tara EUROPA, which is the sea component of TREC, Tara measures the invisible living majority in marine coastal ecosystems, which has been so important to shape diversity over the last 3.5 billion years, and is today sustaining human societies and planetary health. Importantly, the sea and land sampling is opening new dimensions to explore and question ocean life as a whole, allowing us to image and measure the sub-cellular structures and molecules within the most important cells and holobionts at the core of marine ecosystems."

Dr Colomban de Vargas, Research Director CNRS & Sorbonne Universite, Tara EUROPA Science Director

"TREC explores the interactions of the two major ecosystems on our planet. We bring molecular sciences to environmental research, and connect the European life science community across countries and disciplines, to better understand how these ecosystems interact, and how organisms within them respond to natural and human-made environmental changes."

Professor Peer Bork, Director EMBL Heidelberg and TREC Coordinator

2. Understand the interactions between humans and the planet

The TREC expedition will:

- discover the inextricable and complex connections between planetary and human health (One Health at the interface between land and sea)
- contribute to understanding the impact of pollution and global climate change on biodiversity and coastal ecosystem functions
- help to understand other societal challenges such as antimicrobial resistance by exploring how the genes involved can spread between organisms and across ecosystems

3. Highlight the importance of collaboration, scientific training, and public engagement

The pan-European expedition will:

- create value for society by bringing together experts in different countries and disciplines for a joint initiative that aims to address many of the challenges our planet faces today
- deliver knowledge and advanced technologies for the benefit of the scientific community in Europe and worldwide
- engage the general public in debate and discussion to raise awareness of the role of science in society
- inspire the next generation of scientists by raising awareness of the importance of understanding life on this planet among pupils and teachers

"EMBRC's marine research stations and institutes have been actively studying the sea and its biodiversity for decades. We are excited to contribute our collective expertise to such an important initiative that will undoubtedly lead to new discoveries and a deeper understanding of the impact of anthropogenic pressures on marine life. It is through expeditions of this scale and magnitude of TREC that we will be able to gain insights into the functioning of the natural world and understand the impacts our actions are having on life below the waves, the knowledge that we need to properly look after our oceans for the next generations to come."

Nicolas Pade, Director General, EMBRC

An expedition where land meets sea

TREC expedition stops 2024

Malaga, Spain	Late February
Mallorca, Spain	Early March
Barcelona, Spain	Mid-March
Banyuls, France	Late March
Villefranche-sur-Mer, France	Early April
Pisa, Italy	Mid-April
Naples, Italy	Late April
Calabria, Italy	Early May
Lesina, Italy	Mid-May
Chioggia, Italy	Late May
Split, Croatia	Early June
Kotor, Montenegro	Mid-June
Athens, Greece	Early-July
Thessaloniki, Greece	Mid-July

Follow the expedition via our interactive map

https://trec.embl.de/itinerary.cgi

TREC 2023 IN NUMBERS

8
months of expedition

65
land-sea interface and selected species sampling sites (EMBL)

99
sampling sites at sea (*Tara*)

33.000
samples in total

5
sites with advanced mobile lab support

LEGEND

- Common stopovers TREC / Tara EUROPA
- Port calls Tara EUROPA
- Sampling Coastal Sites
- 2023
- 2024

The TREC expedition began in Roscoff, France, in spring 2023 and will conclude in Thessaloniki, Greece, in July 2024. During this period, researchers from EMBL, the Tara OceanS consortium, together with the Tara Ocean Foundation, and numerous European collaborating institutes and organisations will be working at 120 sampling sites across 21 European countries.

An expedition for and with the European science community

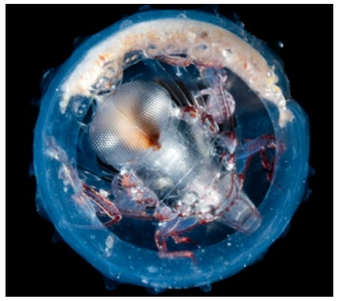
Mobile biological services for Europe

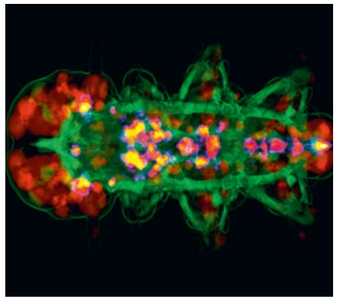
Biological samples are fragile: as soon as a drop of water or crumb of soil is removed from its natural environment, the organisms within them begin to change. To maximise the integrity of organisms and to study them in the context of their natural environment, EMBL is bringing the lab to the samples, instead of samples to the lab.

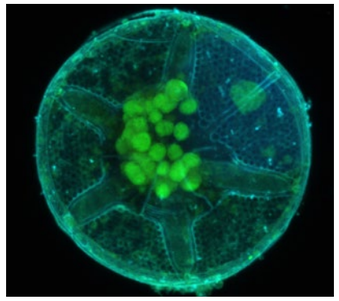
The equipment and technologies which form part of the EMBL Mobile Services will enable scientists to perform leading subcellular research in direct proximity to the field. For decades, EMBL has used, developed, and made available for the scientific community cutting-edge tools and technologies in the molecular life sciences. With the EMBL Mobile Services, we are bringing some of the most advanced technologies to laboratories across Europe, from genomics and cell sorting to imaging and metabolomics. Working together with ecology and marine biology laboratories, we can provide services and training to an even wider scientific community, while also understanding how to continue to push the boundaries of such technologies to answer ever more complex questions.

One component of the EMBL Mobile Services is the **Advanced Mobile Laboratory**, a sophisticated laboratory on wheels. It includes cutting-edge light microscopy, sample preparation for (cryo)-electron microscopy, and single-cell pheno-genomics. Additionally, advanced tools for environmental measurements from soil, air, sediment, and water samples are part of the standard equipment.

By providing these technologies across Europe throughout the expedition, the EMBL Mobile Services support the interdisciplinary approaches that underpin TREC. They allow exceptional exploration of the molecular and sub-cellular processes underlying ecosystem functioning, while also enabling standardisation of experimental protocols on an unprecedented pan-European scale.







Underpinning research and knowledge sharing across Europe

At the heart of TREC is the collaboration with numerous national and international partners, in particular European marine stations in 21 countries from Portugal to Estonia and Finland to Greece. This way the expedition creates not only a uniquely full picture of coastal ecosystems, but also long-term links between researchers, disciplines, and countries across Europe.

TREC brings some of the most advanced technologies available to life scientists to the field. In doing so, it allows researchers to address entirely new questions about fundamental biological processes in ways that have never been done before.

Together with partner organisations and institutions, our scientists offer scientific workshops on different topics and techniques, including hands-on training on the mobile laboratory equipment. This way, the technologies and approaches are made available to a wider scientific community.

TREC's scientific efforts and data collection and analysis will also underpin other important European projects, and contribute to improved scientific, societal, and political understanding of the importance of maintaining the biological health of our seas and coastlines. Examples include the interdisciplinary European Commission-funded project BIOcean5D **www.biocean5D.org**

Supporting wider societal efforts

Science for the European public

Societal change needs society to act. This is why we offer different **public engagement and school education activities** along the TREC route and beyond. Citizens can experience first-hand the power of molecular and cell biology in tackling human and planetary health challenges. They can hear from researchers, or explore science themselves, to understand the connections between land and sea, humans, and the planet. Teachers and educators can access training and resources to engage and inspire the next generation of scientists.

In this way, we are stimulating public debate about the role that science plays in society and inspiring the next generation.

In 2023 our teams, together with volunteers, offered public engagement activities in 19 locations in 14 countries. Over 15.500 citizens joined us – among which 2.070 students aged 8 to 18 – and discovered the important role they play in helping to secure the health of our planet, our ocean, and ourselves.

From science to policy

This collaborative scientific effort at the European scale aims to emphasise the vital importance of present and future European legislation on water and coastal ecological states. Through this international and multidisciplinary scientific approach, the expedition aims to provide knowledge and information that will help to clarify the priorities of the EU Green Deal's future investments to ensure healthy and functional ecosystems, and to work towards the urgent goal of improved European global health.

About EMBL

The European Molecular Biology Laboratory (EMBL) is Europe's life sciences laboratory.
We provide leadership and coordination for the life sciences across Europe, and our world-class fundamental research seeks collaborative and interdisciplinary solutions for some of society's biggest challenges. We provide training for students and scientists, drive the development of new technology and methods in the life sciences, and offer state-of-the-art research infrastructure for a wide range of experimental and data services.
EMBL is an intergovernmental organisation 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.
www.embl.org

About Tara

The Tara Ocean Foundation — first public interest foundation in France dedicated to the Ocean — has two main missions: exploring the Ocean to better understand it and sharing scientific knowledge about the Ocean to raise public awareness. For 20 years, the Foundation has been supporting innovative Ocean science, in partnership with world-leading research centers, to study marine biodiversity, as well as observe and anticipate the impacts of climate change and pollution.
Faced with the urgent need to make the protection of the Ocean a common responsibility, the Foundation raises public awareness of the challenges facing the Ocean, educates young generations, facilitates international cooperation and mobilizes policymakers. Thanks to its Special Observer Status at the United Nations, the Foundation actively participates in crucial decisions in favor of the Ocean. Studying and protecting the Ocean means taking care of the global health of our planet and our future.
www.fondationtaraocean.org

About EMBRC

The European Marine Biological Resource Centre (EMBRC-ERIC) is a research infrastructure which aims at advancing marine biodiversity knowledge to support sustainable blue initiatives. EMBRC mobilises scientists, industries, policymakers and international organisations towards open science. Gathering more 70 marine sites in 9 countries across Europe, EMBRC gives access to state-of-art research facilities and expertise in marine biology and ecology from artic to tropical ecosystems.
Through EMO BON (European Marine Omics Biodiversity Observation Network), EMBRC produces genomic data and contributes to the global ocean observation network and the UN Ocean Decade of Ocean Science for Sustainable Development. Actively supporting education, EMBRC promotes training opportunities in marine sciences for future generations.
In the face of global environmental challenges, EMBRC contributes to the European effort in understanding marine biodiversity and to the global science-based decision-making process.
EMBRC was granted the status of European Research Infrastructure Consortium (ERIC) by the European Commission in 2018.
www.embrc.eu

TREC

Traversing European Coastlines

Follow us:

www.embl.org/TREC

Further information:

TREC – Media kit, incl. image and video library

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Imprint

Publisher: EMBL 2024

Layout: Creative Team/EMBL

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