

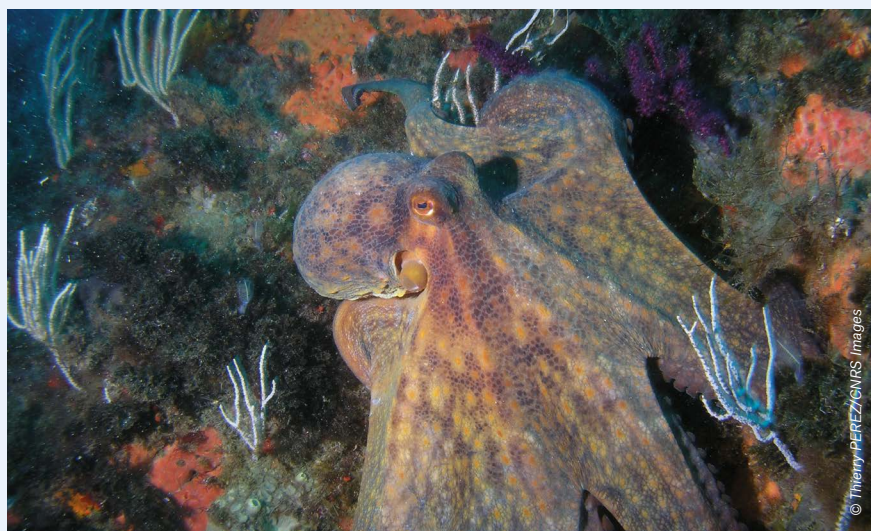
DEGREES

STUDY
IN
FRANCE

MARINE SCIENCE AND OCEANOGRAPHY RESEARCH

In the face of mounting environmental challenges, climate change, pollution and biodiversity collapse, the world's oceans, seas and coastlines have become the focus of more intense, interdisciplinary research.

Through oceanographic research, ecological approaches, resource management, in-situ and satellite observation, and monitoring, over 7,000 professors, researchers, engineers and technicians – representing 4% of public research in France – are involved in studying society's uses of the planet's oceans and seas. These scientists are based in 220 laboratories in France and French overseas departments and territories. They often rely on expertise from various fields such as engineering, climatology, physics, and more.



A large *Octopus vulgaris* in the Strait of Gibraltar off the coast of Ceuta, Spain.

France is one of the top 10 countries to publish the most research in marine and oceanographic science, and is among the top 3 most active countries in the field in Europe (Global Ocean Sciences Report, UNESCO-COI 2020). French research teams are involved in international cooperation projects and actively participate in numerous international and European ocean science programmes, such as the European Commission's Joint Programme Initiative (JPI Ocean) and Future Earth (IMBeR, SOLAS, BioDiscovery).

Biodiversity, its interactions with climate, its reactions to pollution, its living and physical resources, and the development potential of maritime activities are all being examined in new research projects, as the ocean and coastlines play a pivotal role in the climate system.

The 'Ocean and Climate' priority research programme (PPR) is an initiative led by the CNRS and Ifremer as part of a state-funded growth programme and the United Nations Decade of Ocean Science for Sustainable Development (2021-2030). It has identified a number of future research challenges as well as France's demonstrated skill sets in several areas:

- physical, chemical and biogeochemical oceanography;
- the study of the atmosphere-ocean interface, the lithosphere-ocean interface and the land-sea continuum, including water-sediment interactions;
- the development of oceanic and climate models;
- biology, ecology and changes in marine biodiversity;
- marine and ecological restoration and management;
- modelling, management and governance of socioecological systems;
- maritime law and economics;
- marine engineering and technology.

www.cnrs.fr/sites/default/files/press_info/2021-06/05_PPR.pdf

Marine biodiversity is also threatened by overfishing, diversification of maritime practices, physical pollution and chemical and biological contamination that primarily come from land.

It is for this reason that understanding the cumulative impacts of human activity and implementing heightened protective measures have become priorities for research. The ocean still provides ecosystemic services and holds a vast amount of physical and biological resources, which require more research and study. Increasing support has been made available by sustainable development initiatives and programmes. With the development of science and digital technologies, new methods of observing and modelling the ocean have been created, as well as new services for countries, companies in the maritime industry and society.

MAIN RESEARCH STAKEHOLDERS

AllEnvi, the national alliance for environmental research www.allenvi.fr

AllEnvi is composed of public research stakeholders that organise and coordinate France's scientific and environmental strategy in areas such as agroecology and soil, food and nutrition, animals, biodiversity, climate, water, environmental technologies, environmental assessments, ocean science, plants, risks, communities, cities and mobility. AllEnvi awards labels to research bodies, long-term observation and experimentation systems for environmental research, and IBISA platforms for biology, healthcare and agronomy.

Ifremer – National Institute for Ocean Science www.ifremer.fr

Ifremer observes marine environments and studies ecosystems and the processes governing these ecosystems in the context of global change. It designs and implements research and monitoring infrastructure for marine environments. It also operates a large portion of France's oceanographic equipment, which is used by the entire scientific community.

Institut Carnot MERs – Marine Engineering Research for Smart, Sustainable and Safe Seas <https://carnot-mers.com>

The Institut Carnot MERs has 13 units and laboratories that conduct research both upstream (studies, construction and maintenance) and downstream (operation, dismantling) of the value chain in five areas of the maritime industry: shipbuilding, offshore energy, renewable marine energy, fishing, aquaculture and seafood, and boating. Some 200 PhD candidates conduct research at the institute.

Ocean Sciences Institute www.univ-amu.fr/fr/public/institut-sciences-de-locean-ocean

As part of Aix-Marseille University, the Ocean Sciences Institute conducts research and training activities combining oceanography (biology, chemistry, physics), climate science, and marine and maritime engineering with economics, law, history and marine and maritime geography, reinforced by digital sciences and robotics.

Main areas of research at graduate schools

- Chemistry of natural substances
- Coastal engineering
- Coastlines, the environment, remote sensing and geomatics
- Development of marine and coastal uses, resources and areas
- Fishing
- Governance and development of islands
- Marine biological science
- Marine biology
- Marine biotechnology and chemistry
- Marine chemistry
- Marine ecology
- Marine ecosystems
- Marine environment observation
- Marine environmental science
- Marine environments
- Marine geosciences
- Maritime law
- Microbiology of extreme environments
- Ocean geosciences
- Oceanian island environments
- Oceanic and atmospheric physics
- Oceanology
- Physical oceanography
- Renewable marine energies
- The deep sea
- Traditional and contemporary societies in Oceania, and coastal and marine areas
- Underwater acoustics

- Graduate School of Marine and Coastal Sciences (ED 598), *Université de Bretagne Occidentale*: <https://ed-sml.doctorat-bretagnele.fr>
- Sea and Sciences Graduate School (ED 548), University of Toulon: <https://ed548.univ-tln.fr>
- Pacific Graduate School (ED 469), *Université de la Polynésie française*: <http://www.upf.pf/fr/lecole-doctorale-du-pacifique>
- Graduate School of Environmental Science of Île-de-France (ED 129), *Sorbonne Université*: <http://ed129.sorbonne-universite.fr>
- Energy and Environment Graduate School (ED 305), *Université de Perpignan*: <https://www.univ-perp.fr/fr/ecoles-doctorales/ecole-doctorale-energie-environnement>

Top 10 fields for marine science and oceanography research

- Ocean and climate
- Biodiversity and ecosystem functioning
- The deep sea
- Land-ocean relationships
- Conservation of marine resources
- Public intervention, law, safety and security
- Renewable marine energies
- Ports, transport and infrastructure
- Biotechnology
- Shipping and boating
- Offshore energy and mineral resources

Sources: National Council on the Sea and Coastlines - Ifremer

INSU-CNRS – National Institute of Earth Science – National Centre for Scientific Research www.insu.cnrs.fr

The INSU-CNRS manages and co-ordinates research in earth science, astrophysics, and continental, oceanic, atmospheric and astronomic surfaces and interfaces. It engages in scientific forecasting in the areas of atmosphere-ocean interfaces, continental surfaces and interfaces, astronomy and astrophysics, and solid earth sciences. It heads ocean and coastline observation missions and participates in managing national, European and international infrastructure (oceanographic vessels and floats) for research in earth science.

Intechmer – National Institute of Ocean Science and Technology www.intechmer.cnam.fr

Intechmer is a Normandy-based institute that is affiliated with the *Conservatoire national des arts et métiers* (CNAM). It provides training and conducts research in the field of ocean science. Its research covers renewable and tidal energies, natural marine environments and the impact of human activities.

IRD – The French National Research Institute for Sustainable Development www.ird.fr

The French National Research Institute for Sustainable Development is an internationally recognised multidisciplinary organisation. It primarily works alongside Mediterranean and tropical countries. Its research teams study 'ocean resources' and holistically examine issues relating to oceanic development, with a focus on the processes affecting the intertropical zone.



A gorgonocephalus brittle star on ocean reliefs of the Basse du Colombier in Saint Pierre and Miquelon.

IUEM – European Institute for Marine Studies www.iuem.univ-brest.fr/?lang=en

The European Institute for Marine Studies represents a group of seven joint research laboratories (including *Université de Bretagne Occidentale*, the CNRS and the IRD) that work in the field of ocean science. Alongside its 500 staff members, it carries out oceanic and coastal observations in its capacity as an Earth Science Observatory (*Observatoire des Sciences de l'Univers*, OSU). The IUEM also provides training in the form of eight master's programmes and manages the Graduate School of Marine and Coastal Sciences (ED 598).

INRAE – National Research Institute for Agriculture, Food and Environment www.inrae.fr

INRAE co-ordinates scientific and technological research in a range of fields such as agroecology, nutrition and global health, biodiversity, bioeconomics, climate change and risks, society and communities.

IUML – University Institute of the Sea and Coast <https://iuml.fr>

With more than 600 researchers and 19 research units, the IUML conducts its research in four main areas:

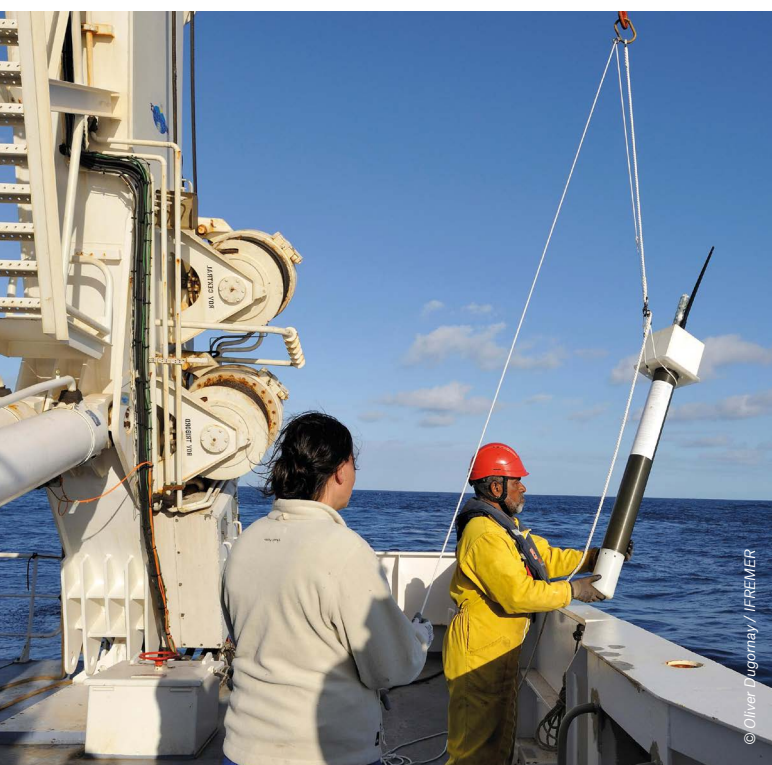
- Marine bioprocesses and bioresources;
- Offshore construction, the vessels of tomorrow, renewable marine energies;
- Biodiversity, healthcare and the coastal environment;
- Blue growth and governance of maritime zones.

MNHN – Muséum National d'Histoire Naturelle www.mnhn.fr

More than 20% of all newly encountered marine species described in the last 10 years have their holotypes – a single physical example used when a new species is formally described – held at this museum. Among the museum's research areas are the study of the biodiversity present in Antarctica (with the aim of creating protected marine areas), explorations of South and East Asia and Oceania, the study of life cycles between rivers and oceans, and the impact of light pollution.

French Marine Universities Network www.universites-marines.fr

In France, 17 universities conduct research and develop higher education programmes focusing on the ocean and coastlines. This network conducts research in marine science and works in partnership with laboratories affiliated with national organisations (the CNRS, Ifremer and the IRD). In addition to actively pursuing research activities, the universities provide training to more than 3,700 students of ocean science, from the undergraduate to the postgraduate levels.



The Argo-Arvor profiling float is an underwater instrument that measures ocean temperature and salinity.

LABORATORIES OF EXCELLENCE

Labex ARCHIMEDE, archaeology and history of the Mediterranean and Ancient Egypt www.archimede.cnrs.fr

This laboratory focuses on interactions between cultures and the creation of identities, power dynamics and the establishment of territories, socioeconomic environments and systems, rites and beliefs. The technology programmes aim to create a digital tool that can record the ancient Egyptian vocabulary of all the hieroglyphic inscriptions etched on the walls of the Karnak temples. The programmes also aim to perfect the archaeology information system so it can more adequately record and process excavation data.

Labex CORAIL, coral reefs in the face of global change www.labex-corail.fr

The Labex CORAIL focuses its research in three main areas: i) biological interactions and processes, from the molecule to populations (study of host-microbiome relationships, the concept of the holobiont, coral diseases, chemical signals, biomolecules); ii) socioecosystems (geo-spatialisation of land-sea uses and resources, vulnerabilities of coral socioecosystems, etc.); and iii) macro-ecological functioning of communities.

Labex CeMEB, Mediterranean Centre for Environment and Biodiversity www.labex-cemeb.org

At the Labex CeMEB, research teams study all types of ecosystems, both on land and at sea, and examine all living things, from viruses to whales. Study designs cover wild biodiversity and programmes are conducted on non-food plants. There are a few unique instruments in environmental management and conservation biology that can create models, analyse data and conduct experiments. One such instrument is the European Ecotron in Montpellier which attracts many international researchers. www.ecotron.cnrs.fr

Labex COTE, evolution, adaptation and governance of continental and coastal ecosystems <https://cote.labex.u-bordeaux.fr/en/>

The Labex COTE works with researchers in biology, physics, chemistry, and the social sciences. In order to understand and prepare for ecosystems' responses to changes caused by humans, it provides tools and methods to regulate and manage their progression. Its 200 scientists work in nine laboratories at Université de Bordeaux and the main national research institutes involved in studying land and aquatic ecosystems, namely Ifremer, the INRAE and the CNRS.

Labex MER, a changing ocean www.labexmer.eu/fr

In the face of climate change and the scarcity of resources, Labex MER aims to bolster knowledge and understanding of how the ocean operates. It works with 700 people and 12 research units, including researchers from 3 universities (Université de Bretagne Occidentale, Université de Bretagne Sud and Université de Nantes), 3 research bodies (Ifremer, the CNRS and the IRD), and Centrale Nantes Engineering School.

COMPETITIVENESS CLUSTERS

AQUIMER, the seafood cluster (Boulogne-sur-Mer) www.agrisoi.fr

The main focus areas of this cluster are resources (maximising available resources and creating new ones), industrial performance (new industry approaches and aquatic technology) and seafood of the future (the position of seafood in future food chains).

Pôle Mer Bretagne Atlantique (Brest) www.pole-mer-bretagne-atlantique.com

Alongside its partners, this cluster is involved in a range of activities: maritime defence, safety and security; shipping and boating; energy resources and offshore mining; marine resources; the environment and coastal development; ports; and logistics and maritime transport.

Mediterranean Sea Cluster (Toulon) www.polemermediterranee.com

This cluster aims to sustainably develop the ocean and coastal economy in the Mediterranean basin, Europe and the rest of the world. Its work focuses on bioresources, environmental technologies and the environment, energy, engineering and services, digital technology and robotics.

Qualitropic, the bioeconomy for overseas departments and territories (Réunion Island) www.qualitropic.fr

Qualitropic is a competitiveness cluster created for businesses and research bodies in France's overseas departments and territories that specialise in the tropical bioeconomy. Its work particularly focuses on: changes in tropical resources; improving the sustainability of industrial, agricultural and fishing processes; the development of joint production and organic waste; responding to societal expectations.

INTERNATIONAL AND EUROPEAN RESEARCH PROJECTS AND PROGRAMMES

Ceph&Chefs www.cephsandchefs.com

The objectives of this project are to promote cephalopod products, spread awareness of the 'sea-to-table' value chain, increase knowledge of eating habits and ensure sustainability of fishing activities.

United Nations Decade of Ocean Science for Sustainable Development (2021-2030) www.oceandecade.org

Euro-Argo – European Research Infrastructure Consortium for observing the ocean www.euro-argo.eu

Horizon Europe https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters_en

As part of this European initiative, €117m has been allocated to 20 international projects and 297 partners from 39 countries. This is to contribute to the European Union's mission of 'Restoring our Ocean and Waters', where it aims to protect and restore its ocean and waters, fight against pollution, support the sustainable blue economy, and more. Three projects are co-ordinated by Mercator Ocean, a French operator of analytical services and oceanic forecasts, and Ifremer. France is represented in 12 of the projects.

Human Sea <https://humansea.univ-nantes.fr/en>

Human Sea is a European project that focuses on reforming maritime law in line with the development of human activities at sea and new technology-driven activities.

Marineff <http://marineff-project.eu>

Marineff aims to develop coastal infrastructure along the English Channel that enhances and protects the ecological quality of coastal waters through new biomimetic innovations in France and Great Britain.

Mission Starfish 2030 for the health of oceans, seas, coastal waters and internal waters <https://starfish2030.ifremer.fr>

MOPGA <https://www.campusfrance.org/fr/make-our-planet-great-again-0>

'Make Our Planet Great Again' is a scholarship programme for researchers who wish to contribute to the fight against global warming. Launched in 2018 and funded by the French Ministry of Europe and Foreign Affairs (MEAE), this Campus France-led programme provides assistance to 40 researchers wishing to pursue their research in France. The programme is also supported by the French Ministry of Higher Education and Research.

2021-2027 Priority Research Programme on Oceans and Climate www.cnrs.fr/sites/default/files/press_info/2021-06/05_PPR.pdf

SHOM, 300 years of French hydrography www.shom.fr

The Global Ocean Observing System www.goosocean.org

Useful links

- **AllEnvi**, the national alliance for environmental research: www.allenvi.fr
- **CNML**, the National Council on the Sea and Coastlines: <https://www.mer.gouv.fr/conseil-national-de-la-mer-et-des-littoraux-cnml>
- **French Ministry of the Environment, Energy and the Sea**
Committee on Marine, Maritime and Coastal Research: www.ecologie.gouv.fr/comite-recherche-marine-maritime-et-littorale
- **French Polar Institute – Paul-Émile Victor**: <https://institut-polaire.fr/en/>
- **Global Ocean Forum**: <https://globaloceanforum.com>
- **Ifremer**, National Institute for Ocean Science: <https://en.ifremer.fr/>
- **INSU-CNRS**, National Institute of Earth Science: www.insu.cnrs.fr
- **IUEM**, European Institute for Marine Studies: www.iuem.univ-brest.fr/?lang=en
- **Marine Universities**: www.universites-marines.fr
- **Mercator Ocean International**, French operator of oceanic information services: www.mercator-ocean.eu
- **MNHN, Muséum National d'Histoire Naturelle**: www.mnhn.fr
- **Ocean Sciences Institute**: www.univ-amu.fr/fr/public/institut-sciences-de-locean-ocean
- **One Planet Summit**: <https://oneplanetsummit.fr/en>
- **SEA-EU**, European University of the Seas: <https://sea-eu.org>
- **STELLA MARE Platform**: <https://stellamare.universita.corsica>
- **UN e-SEA**, Sea Sciences Digital University of Université de Nantes: <https://unesea.univ-nantes.fr/en>
- **UNESCO**, Global Ocean Science Report, COI, 2020: <https://en.unesco.org/gosr>

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