

COMPANY PROFILE

International

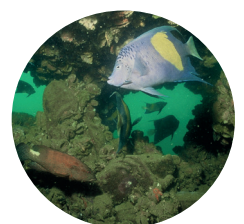


creocean

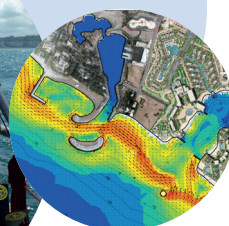
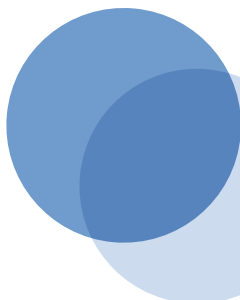
Environnement & océanographie

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1 - Creocean key points

1.1 Creocean overview

Marine environment, coastline planning and oceanography have been at the heart of our work for over 70 years along the entire French coastline and for more than 30 years abroad.

Our diagnostic, appraisal and recommendation work lies within the «Sustainable Development» dynamic by allowing projects to evolve alongside economic development of maritime territories whilst respecting environmental issues.



1.2 Creocean a company of KERAN

Creocean belongs to KERAN, an independent private group, providing global services in support of land and environmental development.

Alongside Keran's other companies, we share a global approach to coastal and offshore planning projects. Together, we provide a complete offer, constantly striving for integrated and sustainable planning and management.



1.3 Creoccean's background and commitment

1.3.1 History

KEY DATES:

1948	Creation of the CREO association: Center for Research and Oceanographic Studies
1980	CREO becomes a limited liability company
1984	IFREMER holds a part of the CREO Ltd company's capital
1987	Creation of ECOCEAN
1991	Merger / absorption of CREO and ECOCEAN giving Creoccean
1997	IFREMER sells its shareholding to SCE Group (95 % of Creoccean capital)
2014	New identity of the Group SCE becoming KERAN
2016	Creation of the subsidiary Creoccean Indian Ocean
2021	Creation of the subsidiary Creoccean Mozambique

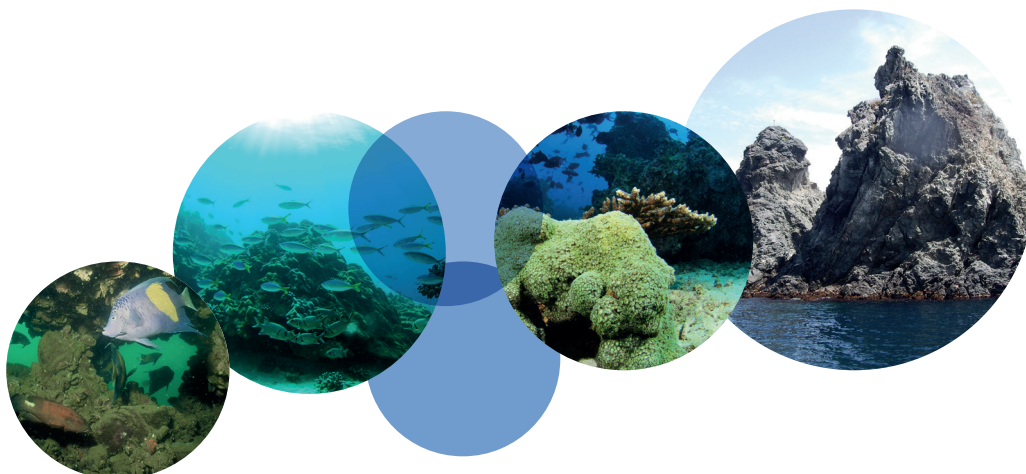
More than 70 years after CREO's creation, we are proud to carry on this legacy: respecting scientific ethics, upholding the idea that multidisciplinary skills are necessary for the understanding of coastal and offshore marine environments. During all these years, while following technical and scientific advances, we also evolved with changing societies within the framework of Sustainable Development.

1.3.2 Commitment

Coastal development is ever increasing and remains a major concern all over the world. It is widely recognized that the development of urban, industrial, agricultural or touristic activities close to or in the marine environment needs to be managed in accordance with the principles of environmental conservation.

Based on its long-term worldwide experience and multidisciplinary scientific approach, Creoccean has nurtured a functional vision of Sustainable Development in the marine environment.

Creoccean is committed to provide science-based decision-making tools for the Sustainable Development of coastal activities in harmony with humans and their natural surroundings.



For each of our projects, the solutions Creoccean provides address three main concerns :

- > The preservation of human and natural legacies: threatened and endangered species, biodiversity, and the integrity of coastal and underwater ecosystems require sound management practices to ensure the sustainable use of natural resources
- > The harmonious development of coastal activities: each urban, port, industrial, agricultural or touristic development may affect surrounding resources and activities. Creoccean endeavors to prevent harmful impacts and conflicts between different activities by drawing on rational management of coastal and marine resources.
- > The development of sustainable facilities and activities: coastal resources and habitats have specific characteristics that must be taken into account with each new project. The success of some of these activities requires that natural resources be kept in pristine condition.

Since its inception, Creoccean has conducted scores of projects linked with coastal and offshore environments. Creoccean has gathered and processed data, conducted baseline assessments and monitored resources, and carried out impact studies as well as a multitude of environmental analyses.

Thanks to its mobility, multidisciplinary expertise, decades of experience, and an extensive professional network, Creoccean can listen to, understand, and meet the requirements of its customers. In doing so, Creoccean continues to develop its legacy of long-term relationships based on satisfied customers.



1.3.3. Health and Safety at Work

Our professions lead us to regularly intervene at sea to collect data on the environment that is dear to us, in sometimes difficult conditions.

« La mer est un espace de rigueur et de liberté. Y perdre la rigueur c'est perdre la liberté. », Victor Hugo

(Translation: The sea is a place of rigor and freedom. To lose rigor is to lose freedom)

In 2013, Creocean's management initiated a process to set up an HSE management system (Health, Safety and Environment) to ensure the safety of people and the preservation of the environment in all our activities, in the field as in the office. For this purpose, the «HSE Team» was created to develop the system from the OHSAS 18001 standard and to make it live on a daily basis.

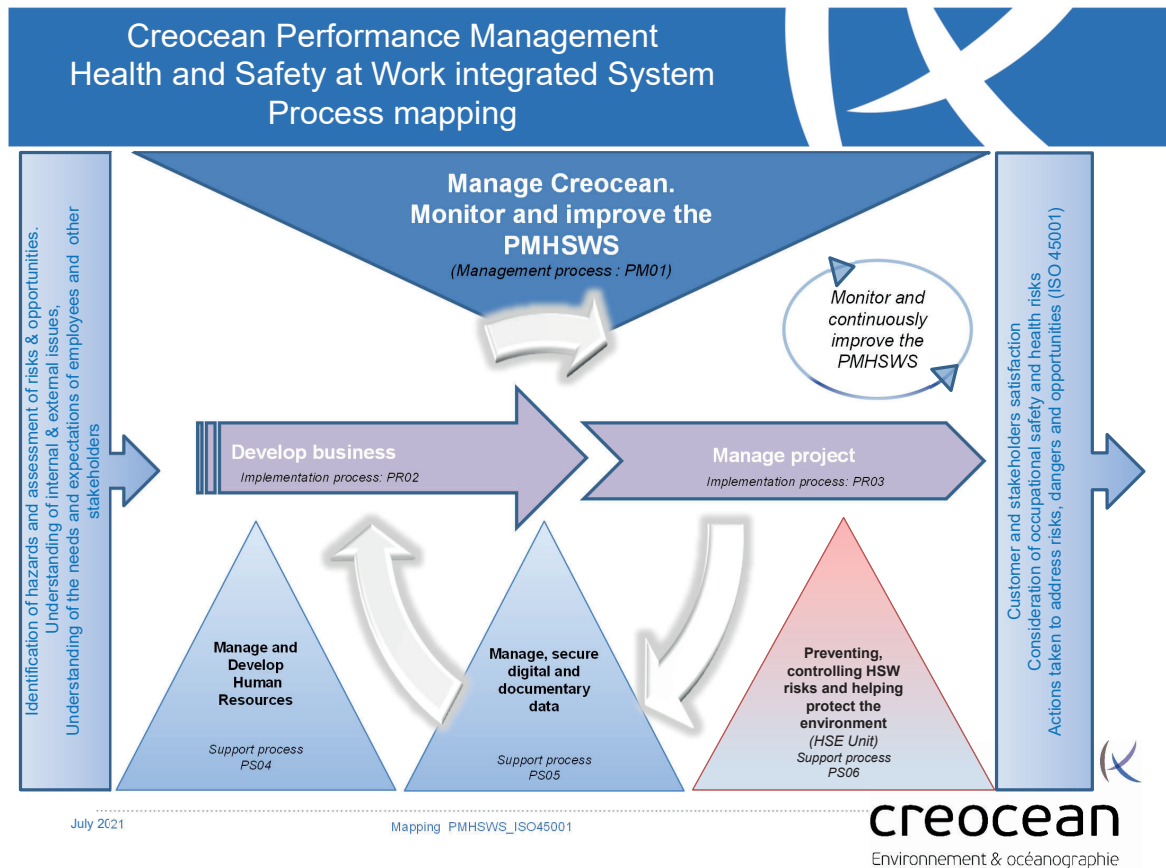
This initiative was based on the conviction that these themes must be at the forefront of all our concerns but also to meet the requirements of our industrial customers.

In 2018 and for 3 years, Creocean's head office was certified OHSAS 18001 by Bureau Veritas.

In 2021, Creocean adapted and migrated to the new ISO 45001 standard with agility and success!

More than ever, health, safety and quality of life at work are at the centre of our concerns. In all our activities and for all staff, the health and safety of people and protecting the environment are our priorities. Management by processes enables Creocean to be part of a desire for continuous improvement which involves all employees on a daily basis, as well as our partners and subcontractors in particular.

The implementation of Creocean's Strategy, as well as its HSW Policy presented below, are deployed through performance indicators.



HEALTH AND SAFETY POLICY

Through our corporate culture and expert services, we support public and private entities for their needs in oceanographic services, the sustainable development and planning of coastal areas by providing a better understanding of the marine environment.

Our mission is to support the development of coastal and offshore areas while respecting local inhabitants and their environment.

To achieve this goal with the respect for people and the environment, our policy relies on the following 6 commitments for this year:

1. **Put people at the center of all CREOCEAN activities.**
2. **Anticipate operational uncertainties thanks to an ingrained culture of risk prevention.**
3. **Eliminate hazards, reduce risks, and keep emergencies under control.**
4. **Strictly respect the laws and regulations in force, as well as the requirements of our customers.**
5. **Give preference to partners who share our values in terms of safety, health, and the environment.**
6. **Inform and dialogue with our employees.**

Health and Safety in the workplace is our top priority and is necessary for the proper functioning of CREOCEAN.

I am committed that these axes remain our priority and that they be continually improved upon through December 2021.

La Rochelle, 14 April 2021



Denis VALANCE

Chief Executive Officer

1.3.4 Engineering qualification (OPQIBI)

Since June 2008, creocan has been awarded OPQIBI certificates.

The OPQIBI is an independent body accredited by COFRAC (French Accreditation Authority), issuing qualification certificates to companies providing primary or secondary engineering services in the following sectors :

- > Construction
- > Infrastructures
- > Energy
- > Environment
- > Industry

Creocan has the following OPQIBI (Organisme Professionnel de Qualification de l'Ingénierie Bâtiment Industrie) certifications :

PROJECT MANAGEMENT ASSISTANCE (PMA)

0103 - Technical assistance to the contracting authority

SOIL TECHNIQUES

1003 – Geological studies

HYDRAULIC, MARITIME AND FLUVIAL PLANNING AND WORKS

0810 – Assessments in river or marine settings

1107 - Study of river works

ENVIRONMENTAL ASSESSMENT

0612 - Environmental assessment of projects, works and facilities

BIODIVERSITY AND ECOLOGICAL ENGINEERING

0701 - Study of ecosystems. Assessment of flora and fauna



1.4 Creoccean in France

Creoccean has agencies on the coasts of France and in French overseas territories. Creoccean's headquarters are in La Rochelle (West-central France) and its other agencies are in Montpellier, La Seyne-sur-Mer, Nantes, Bayonne and Caen. Overseas agencies are located in Martinique, Guadeloupe, La Réunion, Tahiti, and New Caledonia.

1.5 International development

To ensure strong international development, CREOCEAN has created several subsidiaries or representative offices and benefits from Keran's international operations.

The experience acquired internationally makes it possible to reinforce the quality of the expertise carried out in France :

- > Mediterranean Sea
- > North and South Atlantic Ocean
- > English Channel
- > North Sea
- > Caribbean Sea
- > Red Sea
- > Indian Ocean
- > Pacific Ocean
- > Arabian Gulf
- > South-East Asia





2 - Capability statement

With a project-based approach, we are committed to delivering a high and best quality level expertise regardless of the size or complexity of the project.

Using our large array of oceanographic tools, Creoccean proposes customized environmental approaches to each project, taking into account the nature of the project, environmental characteristics of the area, and the client's needs. We can intervene at an early stage of any industrial or coastal development project to help the client develop the proposed activity in an environmental-friendly manner and throughout the life of the project.

Indeed, with a team of 70 employees, creoccean conducts applied projects as well as Research and Development in biological, ecological, geological, chemical, and physical aspects of coastal and marine environments. Our teams are supported by powerful tools for the acquisition of field data and data processing which in turn offer the most appropriate solutions to our customers.

Our customers include public entities such as local and regional authorities, governmental organizations (Ministries of Environment, Directorates of Planning and Environment, IFREMER – French Research Institute for Exploitation of the

Sea) as well as small and large private companies including TOTAL, SHELL and EXXON MOBIL.

Our services cover all stages of a project from the assessment of an area's potential to the implementation of compensatory environmental measures after its development.



2.1 Physical properties, marine habitat mapping, and biodiversity assessment

At an early stage of any development project, preliminary data are necessary to know the potential of the area for the project and the physical and natural constraints if any. Such feasibility studies include the need for oceanographic, hydrodynamic and metocean data, seafloor and sub-bottom knowledge, ecological habitat mapping and biodiversity assessments.

2.1.1 Oceanographic and metocean data gathering

Creocean is able to efficiently acquire and process oceanographic and meteorological data to determine the physical characteristics and constraints of study sites. These data can also be used to define characteristics of coastal or offshore areas for planning purposes and before the installation of an infrastructure.

The equipment Creocean owns and operates including current meters, 2D and 3D modeling software, allows the measurement of a wide range of physical parameters such as swell, currents and weather conditions.



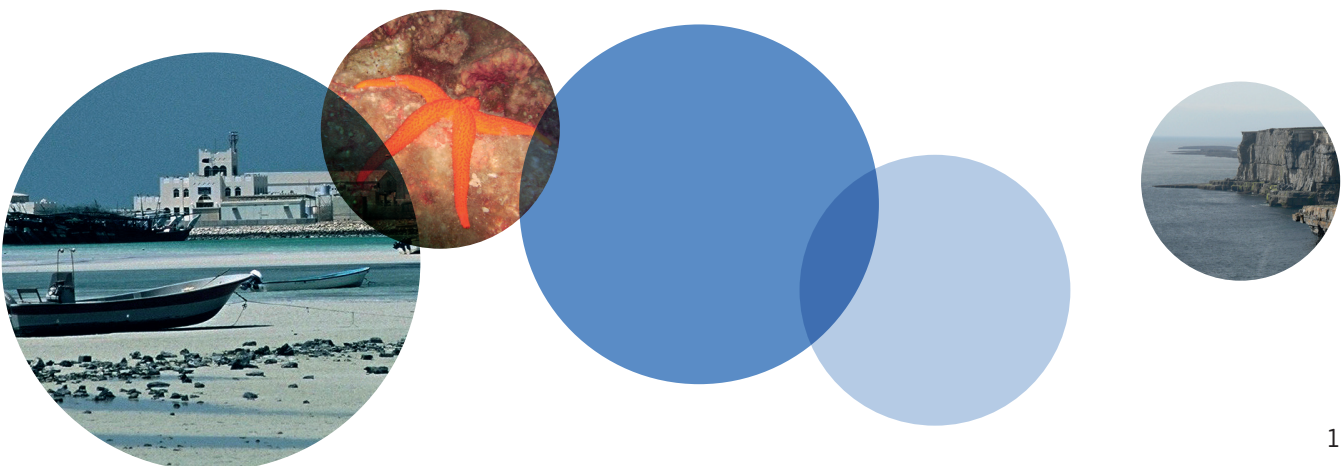
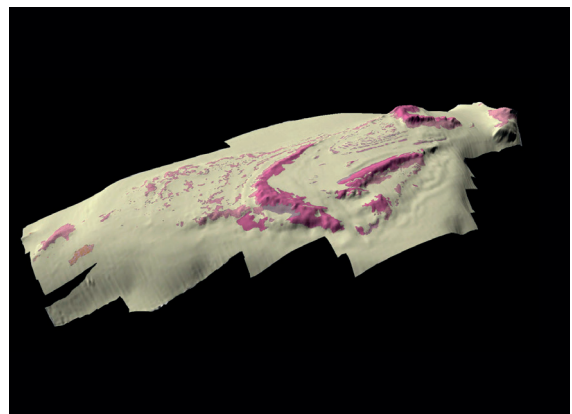
Creocean has generated such data in support of the construction of ports, dredging projects, the laying of submarine pipelines, construction of ocean outfalls, the installation of offshore wind farms and marine power generating units, and for projects addressing shoreline erosion and/or accretion.

2.1.2 Seafloor and sub-bottom mapping

Creocean provides expert services in subsurface geophysics and seismic acquisition and interpretation.

Creocean owns and operates state of the art geophysical equipment for seafloor and sub-bottom mapping including side scan sonar, multibeam echosounder, and seismic very high resolution sub-bottom profilers.

Creocean draws from this substantial array of mapping tools to perform bathymetric, geological, geophysical, sedimentological, habitat characterization, and environmental diagnostic studies in support of any type of offshore, coastal or port development project.



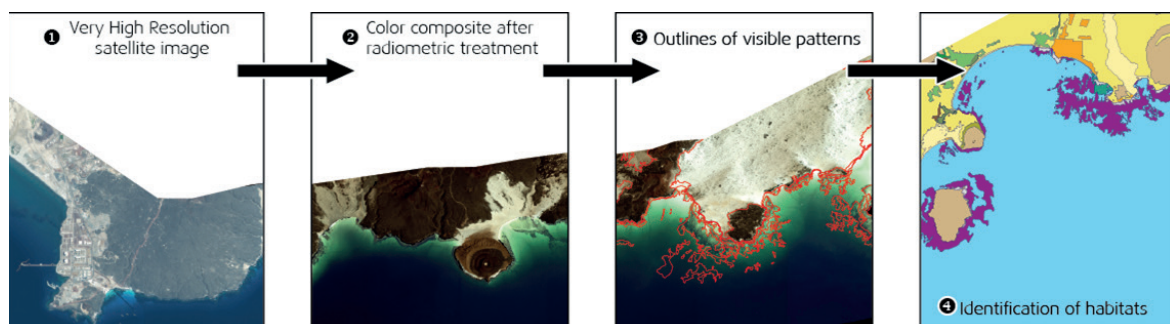
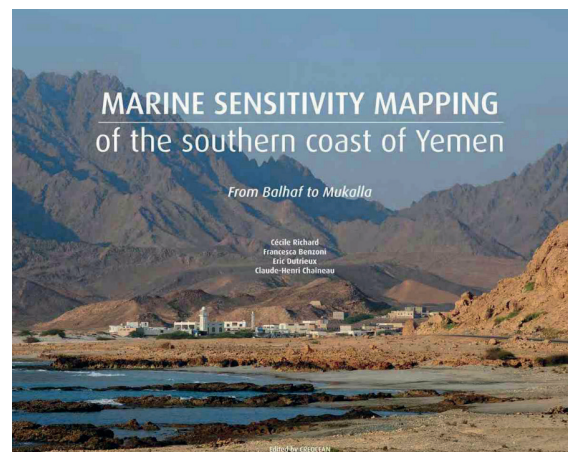
2.1.3 Marine and coastal habitat mapping and biodiversity assessment

The ecological characteristics and sensitivity of an area increasingly impose constraints on any industrial, touristic or urban development project. It can also be very positive for touristic developments of an area as rich and diversified areas attract more and more tourists. Areas with high ecological value have now high economic value.

The approach developed by Creoccean allows the identification of these very valuable areas by associating satellite image processing and interpretation, and field work expertise including scientific diving, underwater photography and in situ observations and biota description.

Our ecological maps generate sensitivity maps easily understandable by decision makers, as and used as planning tools for conservation and sustainable development. Users include governmental organizations such a Ministry of the Environment and private companies such as the Oil & Gas industry.

Creoccean is also capable of conducting in-depth biological inventories in sensitive and biologically-rich areas (open water and seafloor fauna and flora, marine habitats). Collaboration with researchers allows the identification of fauna and flora to the species level.



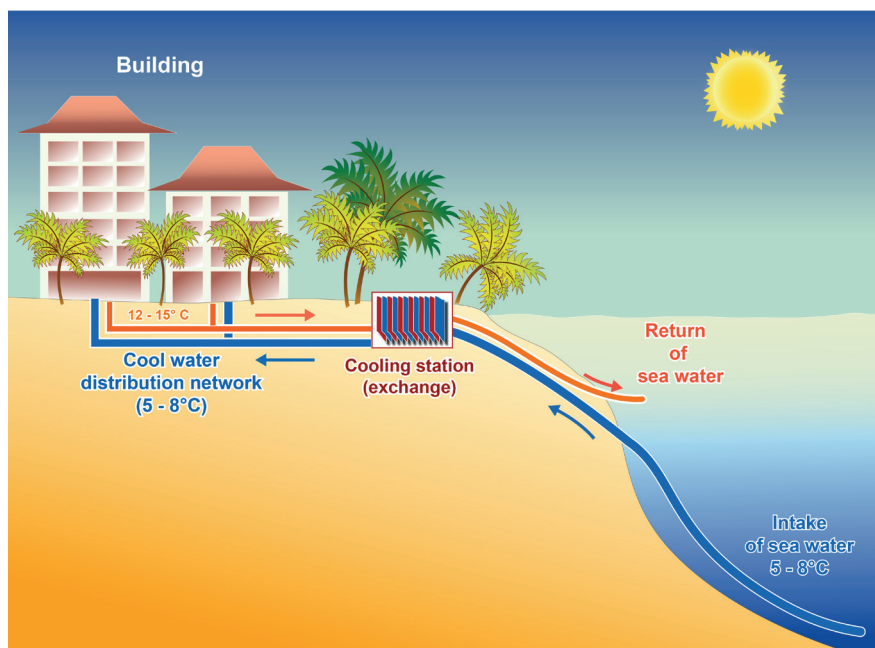
2.2 Coastal Engineering

Based on the potential of the area, Creoccean can size, design, and implement infrastructures taking into account global constraints from currents, tide, wave motion, sediment transport and nature of the seafloor to environmental, regulatory, technical, legal, and financial constraints.

Creoccean engineers carry out coastal management projects such as protection works preventing erosion and coastal flooding, dikes, restructuring of beaches or waterfront and the development of commercial, fishing and recreational ports.

Furthermore, Creoccean engineers design the installation of offshore pipelines for outfalls of water treatment plants, drinking water, and the pumping of cooling water as well as the installation of waterfront and offshore facilities.

Creoccean assists clients during all phases of projects including preliminary studies (diagnostic, strategic, and feasibility studies), design studies (draft, project), consultation with companies and regulatory agencies, and construction work project management.



2.3 Environmental studies

Environmental Impact Assessments (EIAs) are, in most cases, a regulatory process required by governmental authorities in most countries today. In addition they can be required by a financial institution (World Bank, International Financial Corporation) or even be part of the project owner company internal procedures. These approaches generally require two main steps which are the Environmental Baseline study (EBS) and the ESIA itself. Supporting studies are sometimes necessary such as hydrodynamic modeling which Creoccean can also conduct.



2.3.1 Environmental Baseline Studies (EBS)

Creoccean has proven experience and capabilities of conducting EBS'. Tools developed by Creoccean allow to work for any project and in any site, from very shallow areas (lagoons, mangroves, coral reefs) to deep offshore seafloors. Creoccean will tailor the EBS to site-specific requirements.

Typically, baseline studies can include the description and analysis of the following environmental characteristics all of which Creoccean can undertake :

- > Metocean data acquisition
- > Water assessments (hydrodynamics, chemistry, biology)
- > Sediment analyses (chemistry, trace metals, hydrocarbons, pollutants)
- > Benthic faunal and floral assessments in hard and soft bottom areas
- > Fish and fisheries assessments
- > Marine mammal, sea turtle and sea bird assessments
- > Detailed mapping of the study area (remotely-sensed and in situ data)
- > Sensitivity and vulnerability assessments.

Creoccean's in-house expertise is supported by a wide range of instrumentation and sampling equipment to conduct ship-based and in-water studies including grabs, nets, CTD probes, sampling bottles, SCUBA equipment, ROV, video, and a PAM Fluorometer (Pulse Amplitude Modulation).

Creoccean can acquire generate the data needed for environmental impact assessments such as those for dredging, disposal of dredged material, submarine pipe laying, wastewater outfalls, Oil & Gas projects, marine aggregates exploration and production, aquaculture, offshore wind farms or marine energy production units.



2.3.2 Environmental Impact Assessment (EIA)

Creocean has a wealth of experience and expertise in preparing regulatory and compliance documentation. Furthermore, creocean provides the technical expertise to thoroughly determine the environmental consequences of a proposed activity and to develop the necessary project monitoring.

When required, Creocean uses World Bank standards IFC N°6 for large industrial projects such as the extensive Shell exploration project offshore French Guiana.

2.3.3 Complementary studies: hydrodynamic modeling

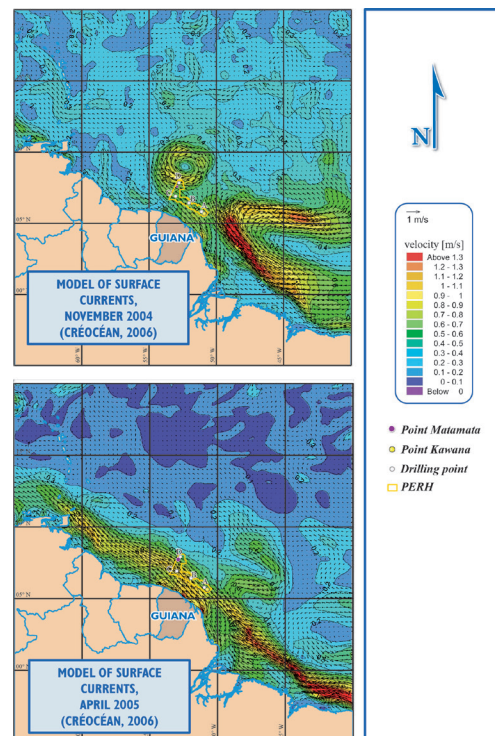
During the process of the ESIA, Creocean can implement complementary studies aiming to generate information on the fate of any discharged substance.

One such study is the implementation of hydrodynamic models. Creocean has extensive expertise with modeling physical processes in coastal and offshore areas, in addition to estuaries, rivers and lakes. This modeling capability allows our clients to forecast and manage dynamic systems.

Creocean has developed a large range of models and can produce 2D and 3D models, currents and agitation simulation models, sediment transport models, advection and contaminant dispersion models.

Creocean provides different types of applications:

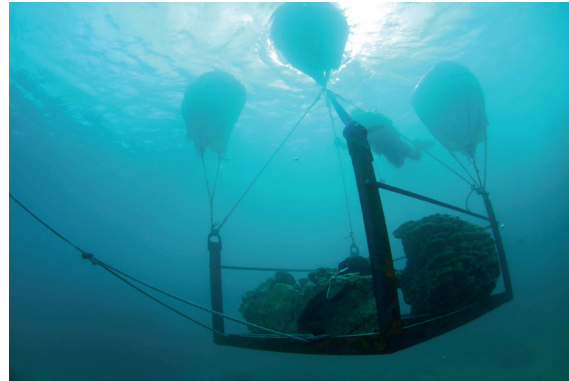
- > circulation models of coastal waters in order to evaluate the impact of wastewater outfalls on marine water quality;
- > harbor oscillations used to design coastal structures, defense works or offshore wind farms;
- > marine submersion models to define overland flooding (within the framework of plans for risk prevention, risk studies to define protection works);
- > hydrodynamic and water quality modeling for coastal development or to assess the impact of coastal infrastructures on water quality and sediment processes;
- > oil spill modeling.



2.4 Implementing mitigation measures

Creocean can develop mitigation measures to advise the client on how to minimize the impact of a project during the phases of construction or operations. These recommendations can be part of the EIA and proposed in the Environmental Management Plan. They can also be designed and implemented during the life of the project based on observed effects or risks.

Mitigation measures are project-specific ranging from small recommendations such as improvements of construction methods statement to major proposals including physical protection of ecosystems or marine habitats (for example the use of silt curtains to protect corals against turbidity plumes), or relocation of sensitive species to a safe place. As an example, Creocean has a substantial experience in successfully relocating corals from areas where they would otherwise be exposed to potential impacts.



To develop mitigation measures, Creocean experts ranging from engineers for the design of any system to marine ecologists. Again this multidisciplinary approach is specific to Creocean.

2.5 Monitoring performance

During the life of a project it is necessary to measure environmental compliance of a project owner. Monitoring can also be applied to natural control areas such as Marine Protected Areas. Conversely, the monitoring results can help identify the sources of impacts and be used to propose measures that limit their effects.

Creocean provides all the tools and expert services for such environmental monitoring and auditing. Marine investigations, for instance, can involve the identification and characterization of effluents, determination of pollutants and their environmental effects.

Monitoring of mangroves, coral reefs, seagrass beds or hard and soft bottom fauna (benthos) are considered as the main ecological targets as they form part of the biological richness and biodiversity. In addition to the description of marine fauna and flora, the identification of the threats is conducted thanks to Creocean's expertise in chemistry, toxicology, physical oceanography, and modeling. This offers a very comprehensive set of skills suited for environmental investigations such as those required in the petrochemical industry, mining, marine aggregates extraction, water treatment / desalination, and the discharge of liquid or solid effluents.



Creocean can also offer comprehensive toxicity testing services for routine monitoring and assessments in marine environments.

2.6 Ecological compensation

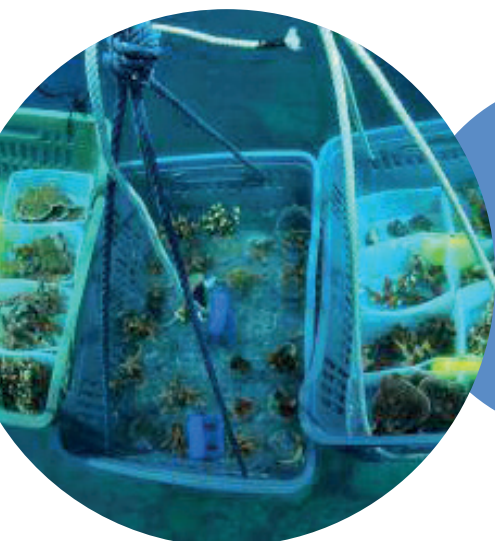
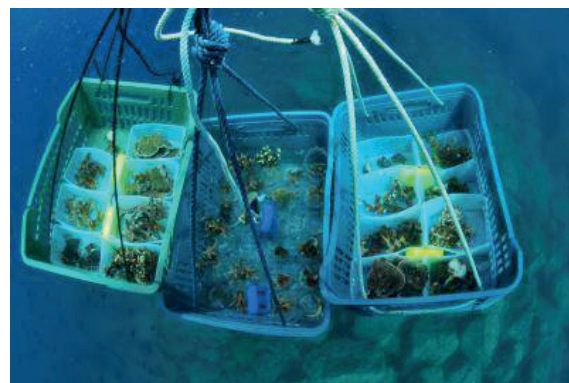
Due to project residual impacts, or due to unexpected marine habitat damage including naturally-occurring diseases, it can be necessary to restore the ecological value of an area and especially its biodiversity, richness and ecological functionality.

Creocean has developed various methods adapted to such situations. They include mangrove and seagrass restoration, coral relocation, coral propagation, and the design, construction and deployment of artificial reefs.

Such operations require combined engineering expertise (designing of artificial reefs as an example) and of biological expertise. In some cases, expertise in sedimentology, hydrodynamics and chemistry is also necessary.

In some cases, expertise in sedimentology, hydrodynamics and chemistry is also necessary.

Creocean will assemble all these experts to conduct truly multidisciplinary and integrated projects. For example, the same artificial reefs can be efficient not only for increasing biodiversity but also for protecting the shoreline against erosion.



2.7 Research and Development: continuously improving tools and methodologies

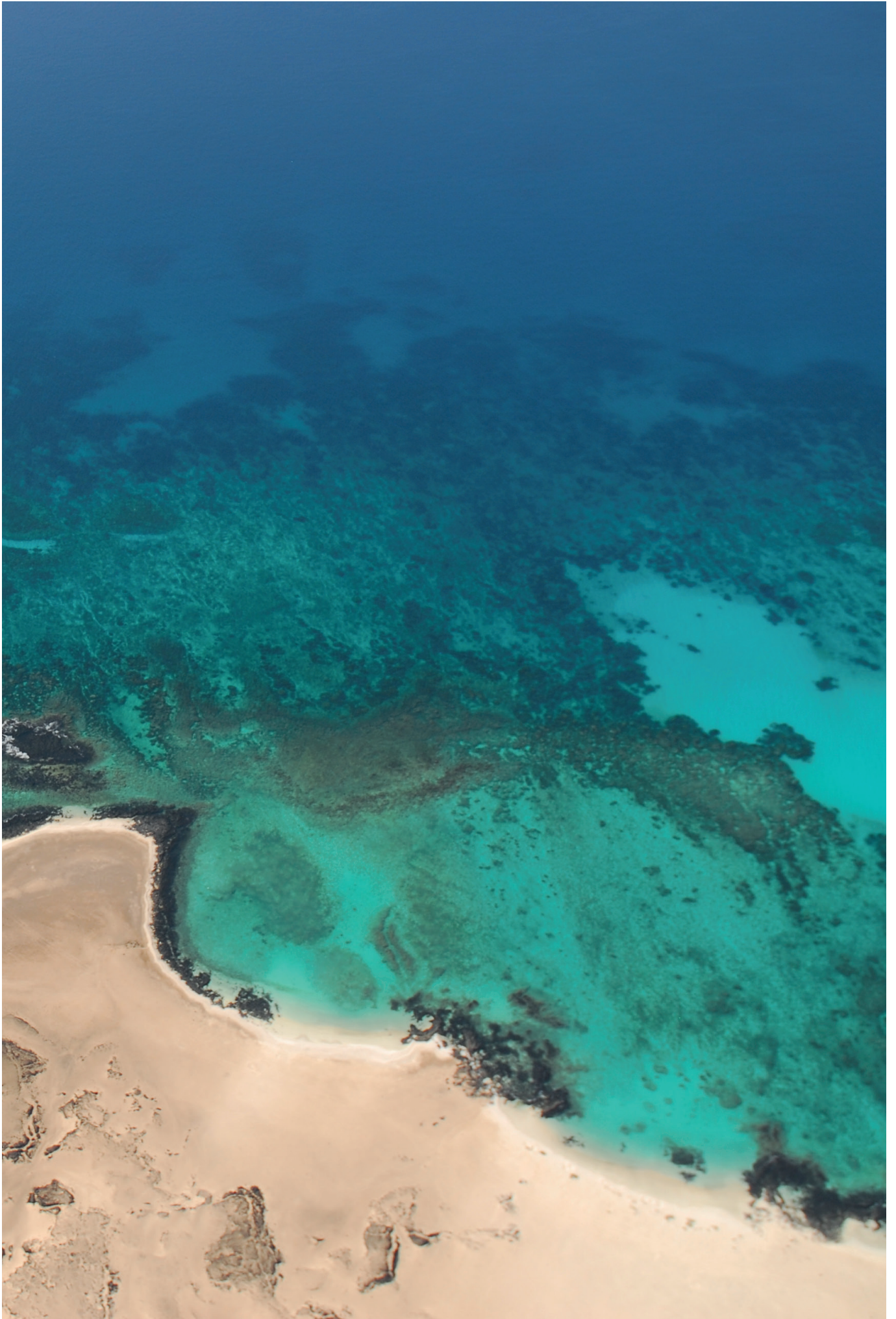
Creocean uses state of the art oceanographic tools and acquires the best performing equipment. However, some projects require specific tools not yet commercially available or that have yet to be developed. With its Research and Development department and team, Creocean develops new tools related to various applications in cooperation with other academic institutions.

Our R&D team has, for instance, developed a monitoring tool for coral and other biota : the Diving PAM (Pulse Amplitude Modulation) for the monitoring of coral health at a very early stage, even before any visible condition such as bleaching. Creocean developed the application of this technique and performed all the required field work to implement the methodology at a large scale.

Through long term collaboration with universities, Creocean also helps develop modern techniques for taxonomy such as DNA analysis. Creocean has for example collaborated with Milano-Bicocca University for coral studies and with CEAB/CSIC in Blanes (Spain) for soft bottom fauna taxonomy.

All these works generated a number of scientific publications and books available to the scientific community.





3 - Staff and organization

In 2020, Creoccean employs 70 people including more than 40 experts representing all areas of marine science. Creoccean is organized in five groups of experts each managed by departments managers:

- > Coastal development
- > Offshore projects / geosciences
- > Environmental studies in the Atlantic Ocean, English Channel and North Sea
- > Environmental studies in the mediterranean sea
- > Environmental studies in international and tropical areas

Projects are assigned to a project manager and a team of Creoccean experts best suited to address project-specific requirements. The project manager is the customer's dedicated point of contact.

3.1 Direction



Yves GILLET
Chairman

Forerunner of sustainable development, at the origin of the SCE French company project and development, which he has been managing for 34 years, Yves Gillet created the Keran group in 2003 around an ambition: to contribute to the development and management of territories at the service of men and in harmony with the environment. Since the beginning in 1982, he has inspired and supported the development of the group around 5 values: Proximity, Audacity, Trust, Talents, Commitment.

Man of conviction and active member of several networks of contractors, Yves Gillet is involved with the men and the activities that make up the territory. He is involved in the French Management Improvement Association (APM), the Entrepreneurs Network, the Western France leaders network and as administrator of the World Trade Center Nantes Atlantique run by the Nantes-Saint-Nazaire Chamber of Commerce and Industry.

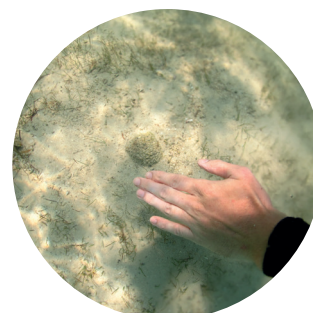
In September 2017, he became Creoccean Chairman.



Denis VALANCE
Chief Executive
Officer

Engineer «Polytech engineering school in Lille - France, Denis VALANCE joined ARCADIS for 10 years, then BURGEAP for 12 years in which he was successively Western Regional Director and Operational Director for France. His main technical skills are related to geostructures, earth sciences and environmental engineering. In addition to his role as technical advisor to his public and private clients throughout France and internationally, he has been managing and leading the SCE Environment Business (KERAN Group) since 2013, notably through the coordination of engineering interventions, SCE experts and partner structures.

In September 2017, he was appointed Creoccean Chief Executive Officer.





Dr. Eric DUTRIEUX
Deputy Chief
Executive Officer
for International
Development -
Creocean Indian
Ocean Chairman

Graduated from high school in agronomy (1984) he is also a doctor in marine ecology (science PhD, 1989). His main expertise is in benthic ecology (soft and hard bottom substrates), including the study of coastal aquatic environments such as lagoons and mangroves. He joined Creocean in 1998 and developed two agencies on the Mediterranean coast (Montpellier and La Seyne-sur-Mer). His experience in international consulting brought him to develop several projects in the Persian gulf, and in 2006 he undertook the responsibility of establishing a Creocean office in the middle-east. From 2004 to 2012, he was head of the environmental monitoring and management department which consisted of twelve PhDs and experienced engineers, conducting studies abroad. In 2010, he became director of international development. Since January 2013, he is Deputy CEO of Creocean in charge of International Development. He has international experience in the organization, management, and environmental evaluation of coastal regions, with specific experience in the assessment of impacts of industrial installations in coastal settings (harbors, oil and gas operations) as well as the restoration/rehabilitation of coastal and marine environments. He is an experienced lecturer and instructor, and has trained staff ranging from environmental technicians to engineers. Commercial diver, he is the author of over 200 technical reports and publications on marine ecology, water pollution assessments and the management for coastal areas. Furthermore he authored five books on marine ecology and scuba diving, including a dozen non-technical journal publications on underwater exploration and the world of scuba diving.



Alexandre SNEESSENS
Creocean Indian
Ocean Director

Graduated from a Master in Oceanography with an in-depth focus and a Master in Biological Sciences, option «Biology of organisms and populations», Alexandre SNEESSENS was an environmental consultant for DHI in Singapore and then Project Manager Engineer at G-Tec in Belgium. Since 2015 he was the Coordinator of the "LIFE in Quarries" project, co-financed by the European Commission LIFE program. He has managed international projects and teams in the fields of oceanography, geophysics but also environmental studies. In September 2020, he was appointed Chief Executive Officer of CREOCEAN Indian Ocean.



3.2 Department Managers

3.2.1 Coastal development



Nicolas JARRY

Dr Nicolas Jarry, head of coastal management in CREOCEAN pursued a career as coastal engineer specialized in marine hydrodynamics, coastal works design, climate change adaptation and vulnerability studies. He is now expert in those fields. He has been supervising teams during more than 10 years (France, Australia, and Dubai) first as project manager from feasibility studies to works supervision for large-scale projects in France and abroad, then as project director. He also wrote many scientific publications, gave conferences on coastal development, consequences of climate change, increase of the sea level and energy transition. Finally, he participated in legal and juridical expertise at the commercial court of Nice.

3.2.2 Offshore projects / geosciences

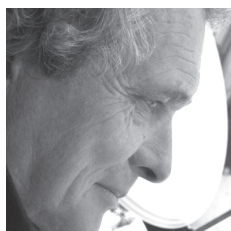


Caroline LABAUNE

Dr. Caroline LABAUNE, Marine Geophysics Project Manager, PhD in marine sedimentology. She has proven experience in nearshore and offshore environment geophysical surveys and in data interpretation. She acquired expert knowledge of the Gulf of Lion environment during her PhD thesis on the coastal and shelf quaternary deposits of the shelf.

As a marine sedimentology and cartography expert, she participated and supervised several geophysical surveys (seismic reflection, bathymetry and seafloor imagery surveys) at sea to conduct cartography of biological communities, offshore wind farm constructions, cable routes, marine aggregate extractions, and so on... She also participates in prefeasibility studies and impact studies.

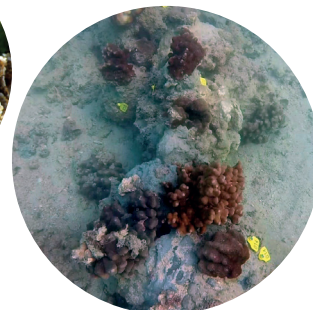
3.2.3 Environmental studies in the Atlantic Ocean, English Channel and North Sea



Philippe GUIBERT

Philippe GUIBERT earned a Master's degree in oceanography, University of Marseille, France (1981) followed by a post-graduate diploma in marine ecology, Orsay Paris Sud, France (1982), and a post-graduate diploma in public relations for Environment, University of Paris VII, France (1986). He started working as a marine biologist for short term contracts before being employed full time by Creoceen in 1990. His activities gradually evolved to marine ecology and he has been for many years head of the Statutory and Environmental Impact Assessment Studies Department consisting of a team of seven engineers.

He has led or participated in more than 280 environmental studies (development projects and related management of marine sites) giving him a wide experience, allowing him to work on a variety of projects, ranging from environmental to impact studies. He and his team mainly work around the Atlantic and Channel Coast of France, but have also taken part in specific projects abroad including the Middle East and Caribbean. He became Director of Environmental Studies – Atlantic, English Channel and North Sea department in January 2013.



3.2.4 Environmental studies in the mediterranean sea

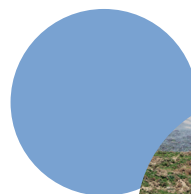
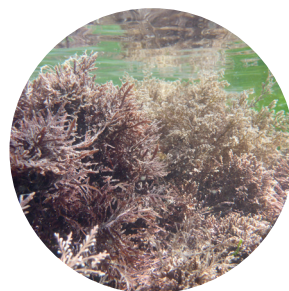


Sébastien THORIN

Sébastien THORIN conducted Post Doctoral studies in Marine Ecology at the University of Rennes, France (2 years), he holds a Ph.D. in oceanography, University of Rimouski, Canada, (submitted in 1998, with excellence), a Post-graduate diploma (1 year) in «Adaptation and survival in extreme environments», University of Lyon I- Aix-Marseille II, France, 1993 (Major) and a Master of Science, Organisms and Populations Biology, Ecology and evolutionary Biology, University of Rennes I, France, 1991.

He initially specialized in neurophysio-pathology. He went onto studying the ecological function of coral reefs, ethology, bio statistics and benthic ecology. He conducted two years of research on the marine trophic network of the Mont-Saint-Michel-Bay at University of Rennes (France).

He joined Creoccean in 2000 as project manager specialized in the management of marine ecology. He became head of the Research & Development in 2012 and Director of Environmental Studies for Mediterranean and tropical zones department in January 2013.



3.3 Creoccean in the world

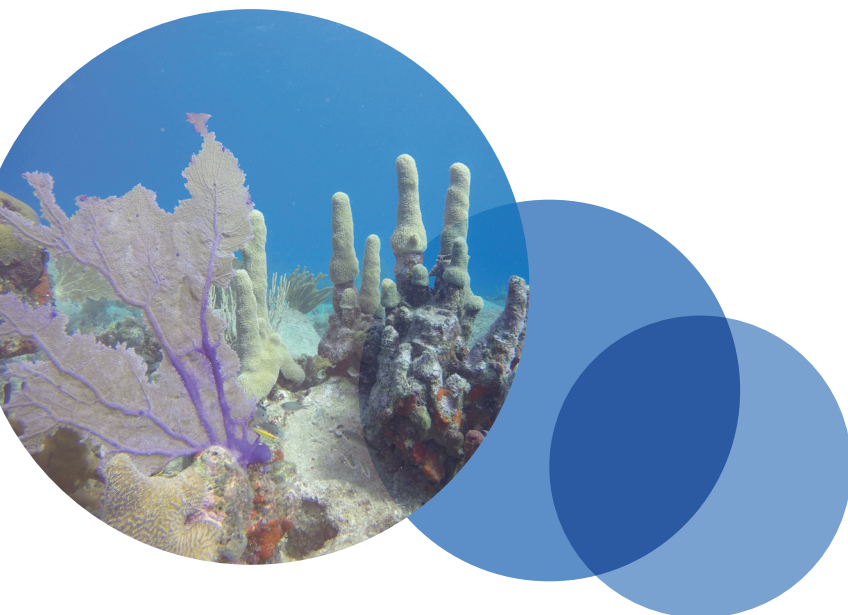
3.3.1 Headquarters

In the early 1970s the Centre for Research and Oceanographic Studies (CREO) moved from Paris to La Rochelle (West-central France).

Nearly 50 years later, located near La Rochelle marina on the waterfront, the buildings were destroyed by the storm Martin in December 1999. After a transition period in temporary offices, during the construction of a new building, the Creoccean headquarters were constructed in July 2004 on their present site near the fishing and the cargo ports north of La Rochelle.

Under the responsibility of its CEO, Denis VALANCE, the building, comprising three levels, houses the management, sales and administration and much of the scientific and technical personnel team.

Almost all the skills of the company are present in La Rochelle and may provide support to French, overseas or international agencies, when needed.



3.3.2 Caribbean zone



Béatrice
de GAULEJAC

Dr in marine biology (PhD) and professional scientific scuba diver, Béatrice de GAULEJAC has more than 15 years of experience in tropical marine and Mediterranean environments. She designs, creates and implements projects, research programs and field studies adapted to the problematics at hand.

As a projects director, biologist and scientific adviser, she has led multidisciplinary teams and has been involved in national and international projects in various domains: environmental diagnostics, resource management, creation of protected marine areas, management plans of natural areas of importance as well as impacts of infrastructures on the coastline.

She has been working for Creoccean in the Caribbean zone since 2015 and became the head of the Caribbean agency in November 2017.

3.3.3 Pacific zone



Brigitte
RAVAIL

Brigitte RAVAIL, Engineer and Project Director, Head of West-Atlantic Agency. PhD in hydrobiology. Hydrobiology and general marine biology specialist, she took on the responsibility of studies relating to the marine environmental quality around port and coastal development areas, water and wastewater discharges or issues linked to eutrophication of areas. She undertakes and leads in particular studies based on marine bio-indicators (benthos, zoo and phytoplankton, ichthyoplankton), especially concerning the characterization of marine habitats and their sensitivity towards different projects such as the immersion of dredging cuttings, aggregate extractions, development of wind farm projects.

She contributes to the redaction of environmental and feasibility studies (extraction of marine resources, aquaculture, coastal development, artificial reefs...) and regulatory studies (impacts, environmental impacts on classified installations for environmental protection).

She is the Head of the Pacific Agency since 2019.



3.3.4 Middle East



Ken
DESLARZES

Creocean has been based in the Middle East since 2003 with the opening of an agency in Doha, Qatar.

The core of the business has been centered on Environmental Baseline Surveys (EBS) and Environmental Impact Assessments (EIA) for the offshore and coastal environments of the Gulf.

These studies have led to a wide knowledge of the local environment as required by Oil & Gas companies to dredging and construction companies.

The main targets of these surveys were to assist and assess the possible impacts related to the marine environment and how we could assist the various actors in reducing their impacts.

In addition to these, Creocean undertook, for the Ministry of Environment (MoE) of Qatar, a large scale mapping of the coast, which consisted in remote sensing and ground truthing surveys.

We have taken part in several Research & Development projects with ExxonMobil since 2009 related to the coral reef and seagrass ecosystems along the coastal waters of Qatar.

These studies have allowed us to gain even more knowledge and develop new tools for use in future projects around the world. Finally, Creocean is active in the field of coral transplantations linked to the development of projects in the Gulf.

Creocean works in close collaboration with local authorities such as various ministries as well as multinational companies developing projects in the region.

We are always looking at expanding our list of clients and are looking to broaden our horizons to the other countries of the Gulf Cooperation Council (GCC).

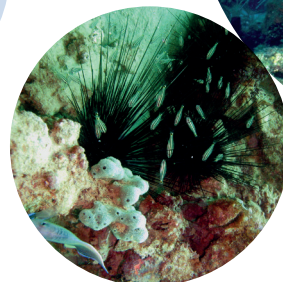
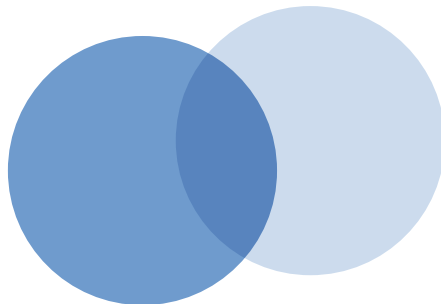
Since 2018, Creocean has its own subsidiary in Qatar, Creocean Doha.

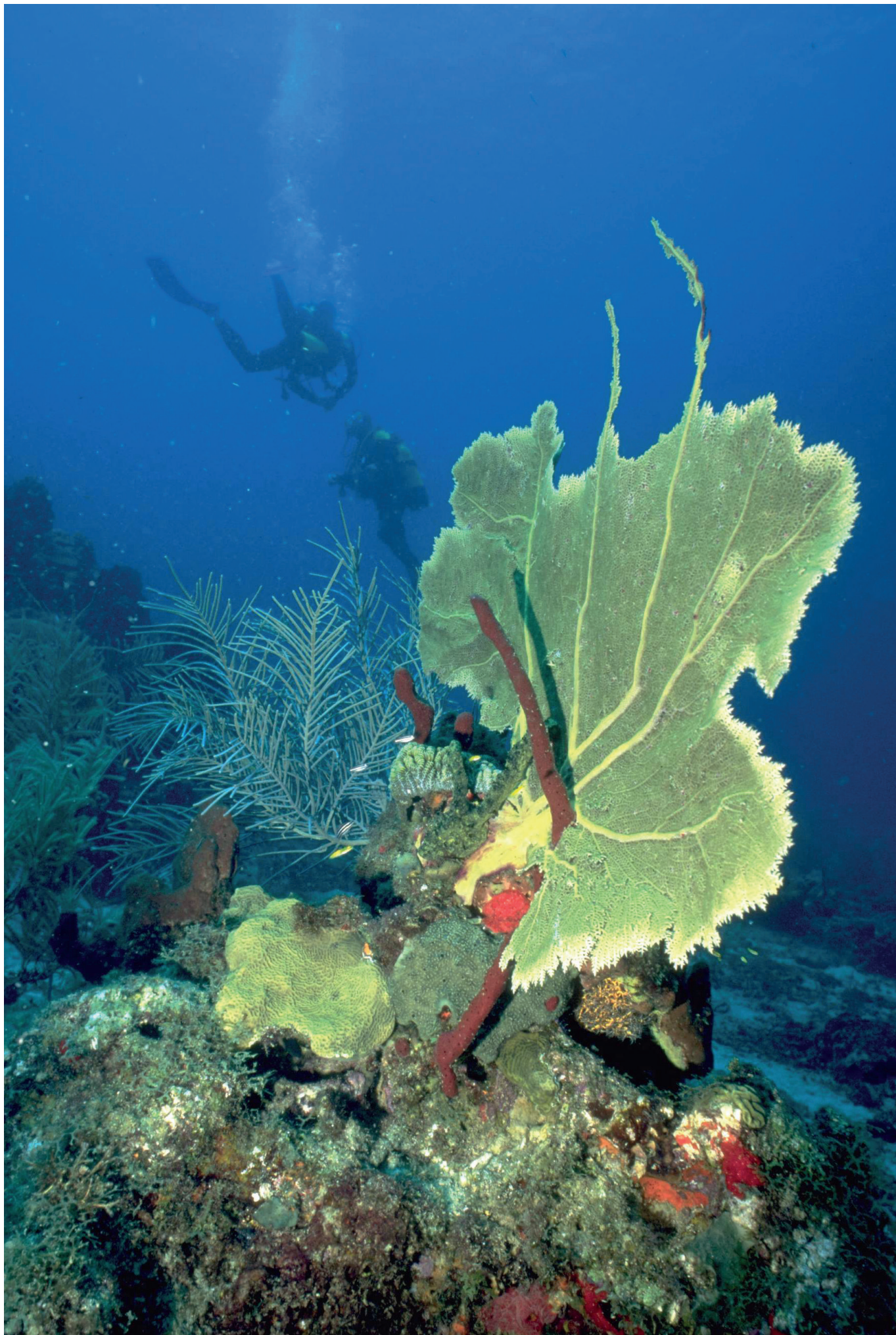


3.4. Experts and technicians

Creocean uses a pool of subject-matter experts and technicians that can be deployed across the globe on short notice:

- > Marine hydrodynamics and numerical modeling
- > Marine engineering, civil engineering, and coastal engineering
- > Coastal development
- > Marine environmental impact assessments
- > Marine biology
- > Marine ecology
- > Integrated management of coastal and marine environments engineers
- > Geology
- > Geophysics
- > Sedimentology
- > Hydrobiology
- > Chemistry
- > Toxicology
- > Hydrographic data acquisition and processing
- > Cartography, graphic design, and illustrations
- > Professional/Scientific SCUBA diving
- > Land and underwater photography and videography





4 – Technical capabilities

4.1. Physical oceanography and modeling

Our competence

- > Assessing agitations (swells, waves, wind waves)
- > Assessing circulation and the movement of water masses (currents, tides)
- > Ability to measure, model, and forecast physical events

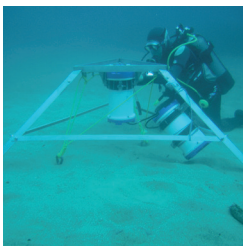
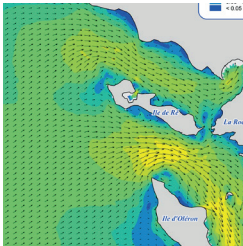
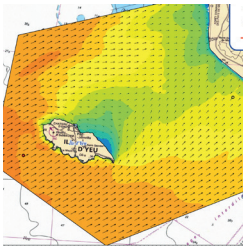
Our tools


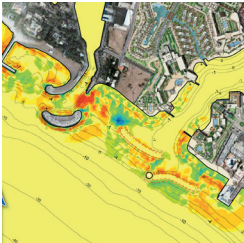
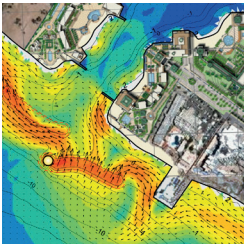
- > In situ physical measuring devices (including current meters, buoys)
- > 2D and 3D modeling software (currents, perturbations, hydro-sedimentary processes)

Objectives

- > Assessment of currents, waves, tides and weather in support of coastal zone management, and coastal planning and development.
- > In situ measurements and mathematical modeling of the physical characteristics of man-made structures and their impacts on the environment.
- > Define physical constraints on coastal and offshore structures and infrastructure (dams, wharves, docks, wind farms, platforms, buoys)



MEASUREMENT	EQUIPMENT	DELIVERABLES
<p>CURRENT AND TEMPERATURE MEASUREMENT</p>  <p>RDI workhorse sentinel</p>	<p>Current meters:</p> <ul style="list-style-type: none"> > RDI Workhorse Sentinel current profiler 300KHz(1), 600KHz(2), and 1200KHz(3) with option bottom tracking. > RDI Sentinel V 100 	<ul style="list-style-type: none"> > Fixed point measurement (bottom moored ADCP) or mobile (floating structure mounted ADCP) > Current velocity and direction time series graphs > Orthogonal velocity graphs > Current velocity and direction histograms > Progressive vector diagrams > Current scatter graphs > Current roses > Residual eulerian currents > Principal component analysis, wind/current relationship > Filtration: current driven by wind or density variation > Spectral and harmonic analysis > Location and evolution of thermoclines
<p>TIDE MEASUREMENT</p>	<ul style="list-style-type: none"> > Pressure & temperature sensors (NKE) > Sensors associated with current or wave measurement 	<ul style="list-style-type: none"> > Sea level time series graphs > Prediction software > Spectral and harmonic analysis
<p>WAVE MEASUREMENT</p>  <p>Datawell buoy</p>	<ul style="list-style-type: none"> > RDI Workhorse Sentinel current profiler 300KHz(1), 600KHz(2), and 1200KHz(3) with wave option > Pressure sensor (NKE) > RDI Sentinel V100 > Non-directional Datawell buoy WR-SG > Triaxys Watch Keeper buoy 	<ul style="list-style-type: none"> > Significant wave height and period time series graphs > Max wave height time series graphs > Significant wave height and period histograms > Probability diagrams > Wave roses, wave spectral and directional energy distribution, wind/wave relationship diagram > Real time measurement
<p>HYDRODYNAMICS</p> 	<ul style="list-style-type: none"> > 3D Modeling with MIKE3D HD FM (DHI) > TELEMAC 2D (EDF/LNHE) > MARS 3D (IFREMER) 	<ul style="list-style-type: none"> > Modeling of currents (sea, estuaries, rivers) > Taking into account general currents, tide, wind, variations in water density (temperature and salinity) > Hydrodynamic base for other models > Modeling of surges > Modeling of land flooding
<p>SWELL, WAVES</p> 	<ul style="list-style-type: none"> > MIKE SW (DHI) > MIKE BW (DHI) > SWAN (Delft) > TELEMAC ARTEMIS (EDF/LNHE) 	<ul style="list-style-type: none"> > Swell propagation towards the coast > wind-induced wave growth > Sea surface agitation induced by the wind > Extreme wave height assessment for design > Coupling with the hydrodynamic model for hydro-sedimentary modeling > Harbour agitation modeling > Potential wave energy estimation

MEASUREMENT	EQUIPMENT	DELIVERABLES
PLUMES, WATER QUALITY 	<ul style="list-style-type: none"> > MIKE 2D/3D AD (DHI) > MIKE 2D/3D PT/SA (DHI) > TELEMAC 2D (EDF/LNHE) > MARS 3D (IFREMER) > CORMIX 	<ul style="list-style-type: none"> > Modeling of all types of discharges (water purification plant, industrial, thermal, dredging discharges) > Taking into account the 3D aspect of plumes > Precise modeling of the plume in the near field > Design of diffusers
SEDIMENT DYNAMICS 	<ul style="list-style-type: none"> > MIKE 2D/3D MT (DHI) > MIKE 2D/3D ST (DHI) > TELEMAC (EDF/LNHE) > MARS 3D (IFREMER) > TRANSPORT (Van Rijn) > Specific developments 	<ul style="list-style-type: none"> > Modeling of transport, erosion and deposition : <ul style="list-style-type: none"> - of non-cohesive sediments (sand) - of cohesive sediments (fine sediments, mud) > Open-sea or coastal modeling (example : beach stability) > Modeling of sediment disposal from dredging
MULTI-THEMATIC 	<ul style="list-style-type: none"> > Coupling of various models 	<ul style="list-style-type: none"> > Modeling of littoral drift > Modeling of beach erosion due to littoral drift. > Morphodynamic modeling (including bathymetric variation due to deposition and erosion processes)



4.2. Coastal geomorphology, sedimentary processes, and seafloor and sub-bottom mapping

Our competence :

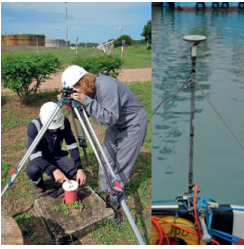


- > Sedimentology, geology and geophysics
- > Subsurface geophysics
- > Seismic acquisition and interpretation
- > Sediment hydro-dynamics
- > Seafloor and sub-bottom mapping


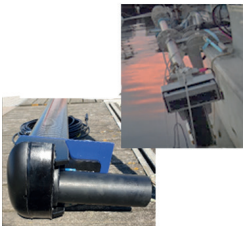

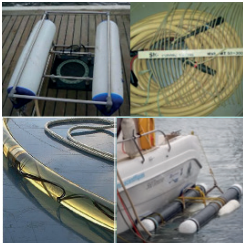

Our tools :

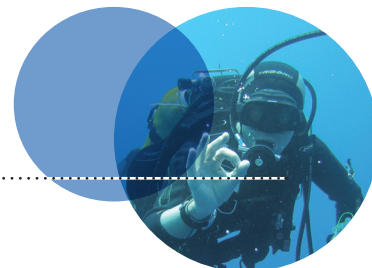
- > Multi-beam Bathymetric Echosounder
- > Norbit WBMS
- > Motion Sensor
- > Seismic very high resolution
- > SBG Navsight Apogee Marine
- > Side-scan sonar
- > Geological and geophysical seabed profiling
- > Field expertise
- > Hydro-sedimentary processes analysis
- > GIS and DTM softwares

Objectives :

- > Describe the physical, geological and sedimentary properties of the coastline, seafloor, and sub-bottom
- > Describe coastline dynamics
- > Analyze hydro-sedimentary processes (sand transit, erosion, accretion)
- > Morpho-sedimentary underwater mapping
- > Detect objects

MEASUREMENT	EQUIPMENT	DELIVERABLES
<p>POSITIONING AND MOTION SENSOR</p>  <p>GNSS RTK</p>	<ul style="list-style-type: none"> > GNSS RTK positioning <ul style="list-style-type: none"> - Thalès Pro FLeX 800 - Full GNSS RTKL solution from Orphéon/Terria in France 	<ul style="list-style-type: none"> > Centimetric/kinematic positioning > Local topography 
 <p>USBL EASY TRACK</p>	<ul style="list-style-type: none"> > Underwater positioning <ul style="list-style-type: none"> - USBL Easy track Lite - USBL Miniranger 2 (rental) 	<ul style="list-style-type: none"> > Dynamic (towed equipment) and static positioning of underwater equipment

MEASUREMENT	EQUIPMENT	DELIVERABLES
 <p>Coda Octopus F185 R+ SBG Apogée Navsigth</p>	<ul style="list-style-type: none"> > Inertial Unit <ul style="list-style-type: none"> - Coda Octopus F185 R+ - SBG Apogée Navsigth 	<ul style="list-style-type: none"> > Vessel/Equipment motion corrections > RTK positioning
<p>BATHYMETRY</p>  <p>R2 Sonic 2022</p>	<ul style="list-style-type: none"> > Single beam bathymetric echosounder (SBES) <ul style="list-style-type: none"> - Navisound 215 > Multibeam Bathymetric echosounder (MBES) <ul style="list-style-type: none"> - R2 Sonic 2022 - Norbit WBMS > Velocity probe <ul style="list-style-type: none"> - Valeport mini SVP > Acquisition and post-processing <ul style="list-style-type: none"> - Hypack Suite - BeamWorks Autoclean 	<ul style="list-style-type: none"> > Morpho-bathymetric charts > Dredging and seabed evolution monitoring > Seabed nature/features mapping using backscatter and sonar mode
<p>SEAFLOOR SURVEYING</p> 	<ul style="list-style-type: none"> > Side-scan sonar <ul style="list-style-type: none"> - KLEIN 3000 side scan sonar - Acquisition and post-processing <ul style="list-style-type: none"> + Sonar Pro + Hypack Suite + IXSEA Delph Sonar interpretation + Caraïbes 	<ul style="list-style-type: none"> > Seabed nature map and sediment dynamics > Underwater wreck or obstacle location > Inspection of pipes or submerged structures > Protection of river banks and structures
<p>GEOLOGY/GEOPHYSICS OF THE SUB-BOTTOM</p> 	<ul style="list-style-type: none"> > Seismic reflexion (very) high resolution <ul style="list-style-type: none"> - Sparker SIG - Boomer SIG (rental) - Boomer IKB-Seistec - Stramer SIG very high resolution > SBP <ul style="list-style-type: none"> - INNOMAR SES 2000 Compact (rental) - ECHOES1000 (rental) - Pinger Knudsen (rental) > Acquisition and post-processing <ul style="list-style-type: none"> - Dedicated software for Innomar/Knudsen > Innomar/Knudsen <ul style="list-style-type: none"> - IXSEA Delph Seismic acquisition et interpretation 	<ul style="list-style-type: none"> > Ground model > Sediment thickness charts (MNT) > Top of substratum detection and mapping (MNT) > Buried objects detection
<p>MAGNETOMETRY</p> 	<ul style="list-style-type: none"> > Magnetometer <ul style="list-style-type: none"> - Marine Magnetics SeaSPY (rental) 	<ul style="list-style-type: none"> > Superficial and buried magnetic objects detection (pipe, wrecks...) > Magnetic anomalies mapping



4.3. Biological, chemical, and physical properties of water and sediments

Our competence :





- > Physical and chemical properties of water and sediments
- > Urban, harbour and industrial environmental quality
- > Marine microbiology

Our tools :

- > Water and sediment sampling, measurements, and analyses
- > Partnerships with specialized independent laboratories
- > Statistics and numerical modeling

Objectives :

- > Detect pollution and stress levels using water column and sediment quality indicators

MEASUREMENT	EQUIPMENT	DELIVERABLES
SEDIMENT SAMPLING  Freegaff corer	<ul style="list-style-type: none"> > Different types of grabs: <ul style="list-style-type: none"> - Smith Mc Inthyre grab - Van Veen Grab - Eckman grab - Free fall corer (cores of 1 to 2 meters) 	<ul style="list-style-type: none"> > Core analysis > Granulometry
HYDROBIOLOGY  Niskin sampler+  YSI probe 6920  Sambat probe	<p>Water sampling bottles (Niskin-type)</p> <p>Multi parameters probes YSI, RBR maetro, Aquatroll with different sensors:</p> <ul style="list-style-type: none"> > Temperature > Conductivity > Pressure > Dissolved Oxygen > pH > Turbidity <p>Probes and NKE data logger</p> <ul style="list-style-type: none"> > STBD > STPS > SP2T > Sambat probe with different sensors 	<ul style="list-style-type: none"> > Suspended solids (organic and mineral) > Nutrients (concentration and flux) > Chlorophyll, phaeopigment > Temperature, salinity, pH, dissolved oxygen > Phytoplankton and zooplankton > Macrofauna and meiofauna > Macrofloral algae

MEASUREMENT

EQUIPMENT

DELIVERABLES

FLOW MEASUREMENT AND WASTEWATERS DISCHARGES



HAC AS950 sampler

- > Automatic sampler Hach



Hydreka Mainflo Flowmeter

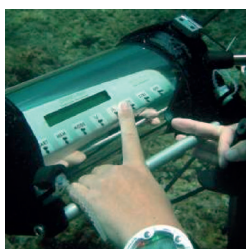
- > Flow measurement Mainflo type



Safety mobile tripod

- > Multi-gas detector,
- > Safety equipment to intervene in a confined space

PHOTOSYNTHETIC PERFORMANCE

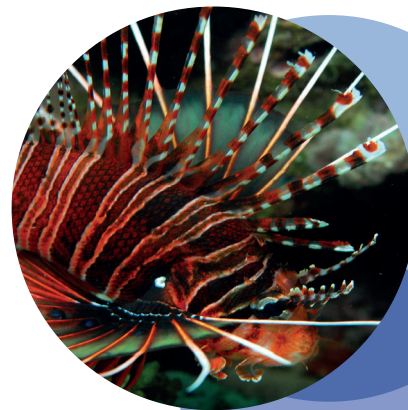


PAM

- PAM Fluorometer (Pulse Amplitude Modulation)

- > Flow Measurements
- > Wastewater sampling and analysis
- > Analysis of flows

- > To monitor the health of corals, seagrass, algae



4.4. Coastal and marine ecology

Our competence :




- > Marine ecology and biology
- > Benthic ecology
- > Biological oceanography
- > Coral reef relocation and restoration
- > Coral reef ecology
- > Seagrass relocation and restoration
- > Experimental fisheries science
- > Coastal zone management
- > Mapping
- > Scientific/Professional SCUBA diving
- > Partnerships with specialized independent laboratories







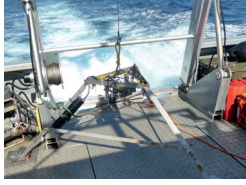
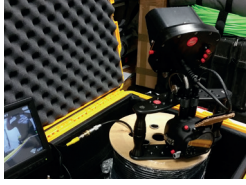
Our tools :

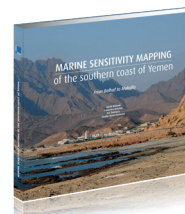
- > State-of-the-art surveying methods
- > Remote sensing tools
- > Baseline and long-term monitoring
- > Biological indices
- > Biostatistics
- > Professional underwater photography

Objectives :

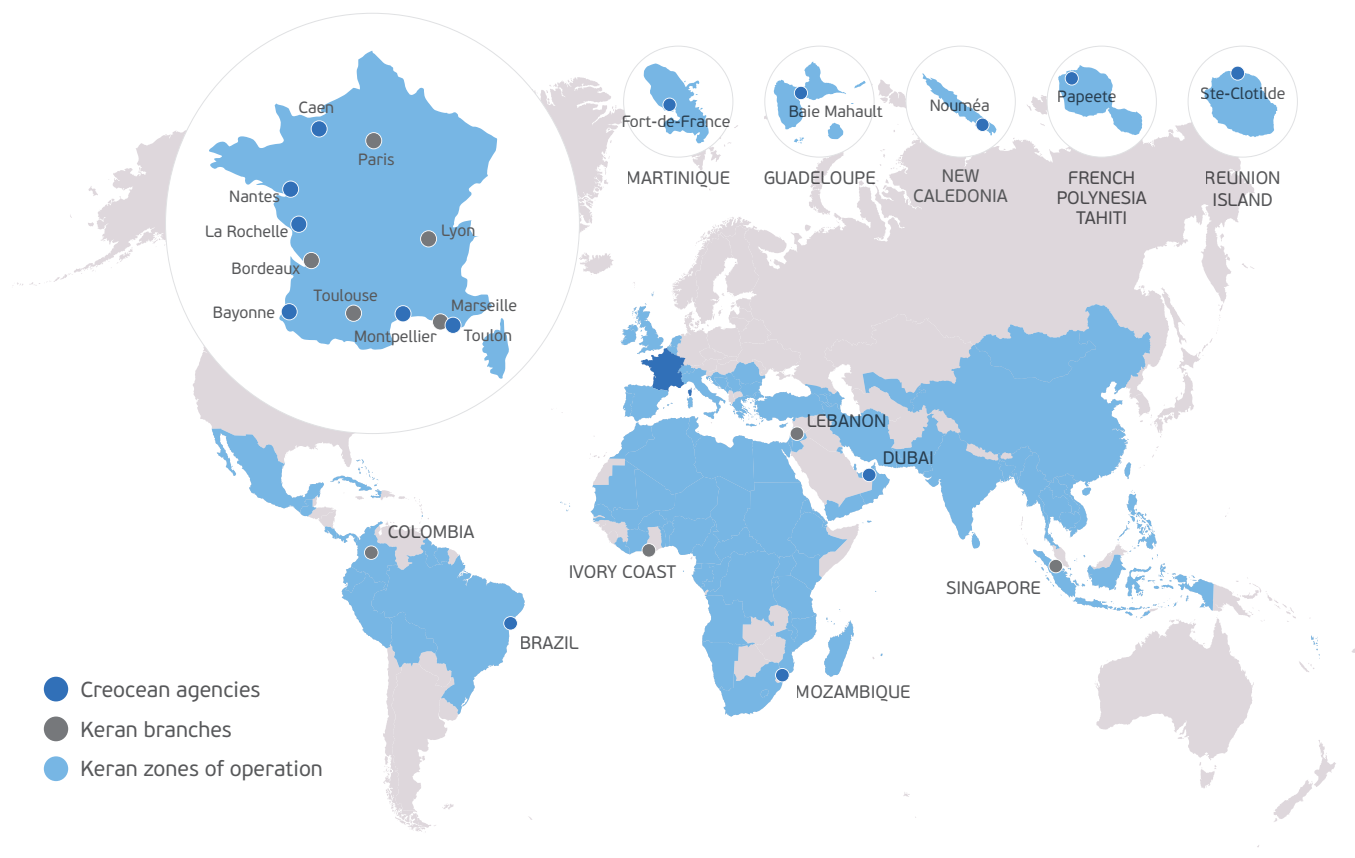
Description, zoning, state of health and sensitivity of coastal and offshore ecosystems, mitigation, and ecological compensation.

MEASUREMENT	EQUIPMENT	DELIVERABLES
BENTHIC MACROFAUNA  <p>Auto siever system</p>  <p>Observation</p>  <p>Leica Binocular magnifier MD80</p>	<ul style="list-style-type: none"> > Sampling grabs > Camera Leica IC80HD > Microscope > Leica Binocular magnifier MD80 > Oven and calcination oven 	<ul style="list-style-type: none"> > Biosedimentary sampling > Screening > Determination of benthic macrofauna > Biomass by calcination > Macrofauna and meiofauna

MEASUREMENT	EQUIPMENT	DELIVERABLES
BONGONET 	<ul style="list-style-type: none"> > Plankton net > Bongo net for ichthyoplankton > Flow meter 	<ul style="list-style-type: none"> > Phytoplankton, Zooplankton and macro algae (eggs, fishes larvae, crustaceans ...) observation and sampling
	Beam trawl : <ul style="list-style-type: none"> - Big = CP3M - Small = CP1.6M 	<ul style="list-style-type: none"> > Sampling of ichthyofauna, including Juveniles. In coastal and estuary zones
VIDEOS AND PHOTOGRAPHIES  <p>ROV LBV 150 SE²</p>  <p>GEOSLAM ZEB Horizon</p>  <p>DJI Phantom4 PRO</p>  <p>Tow wing</p>  <p>Support «DropDown camera»</p>  <p>Hugyfot housing with surface system</p>	Professional SCUBA diving equipment ROV : Seabatix LBV 150 SE ² GEOSLAM ZEB Horizon Photogrammetry and aerial shots equipment <ul style="list-style-type: none"> > DJI Phantom4 PRO V2 capteur 20Mpx Photographic and Video equipment <ul style="list-style-type: none"> > Canon G12 and G16 > Nikon D80, D200, D300, D800 > Sea and Sea, Ikelite and Isotta housing > Flash Ikelite and Nikon SB105 > Macro and large objectives angle > Underwater LED Camera and Lamp > GoPro Camera > Hugyfot housing > Led Euclia Lamp with great power and autonomy > Cage for camera > Trailed wing > Acoustic positioning (USBL) (optional) > Video Recorder > EDIUS6 editing software > Video Overlay TXT 	<ul style="list-style-type: none"> > Video inspection, inventories <ul style="list-style-type: none"> > Lightweight and compact dynamic laser scanning <ul style="list-style-type: none"> > Video and photo inspection, inventories > Photogrammetry (orthomosaic and DSM / DTM) > Virtual reality / augmented reality <ul style="list-style-type: none"> > Corals and benthic assessment > Standard coral monitoring results > Photograph database > Field guides books <ul style="list-style-type: none"> > Results of In Situ observation methods for benthic monitoring (photo-quadrats, Line Intercept Transects, Video records, etc)



creocean in the world



Contact :

Denis Valance
Chief Executive Officer-CEO
Zone Technocéan
Chef de Baie
Rue Charles Tellier
17000 La Rochelle/FRANCE
Tel.: +33 (0)5 46 41 13 13
Fax: +33 (0)5 46 50 51 02
creocean@creocean.fr

Eric Dutrieux (Montpellier)
Deputy Chief Executive Officer for
International Development
Les Belvédères - Bâtiment B
128 avenue de Fès
34080 Montpellier/FRANCE
Phone +33 4 99 23 31 65
Fax +33 4 99 23 31 71
dutrieux@creocean.fr



creocean

GROUPE KERAN

www.creocean.fr