The sea, the environment's and the global economy's new frontier

May 2021

entreprises pour l'environnement

Chairman's message

The globalisation of the world economy has led us to change our view of the ocean: from wild or enchanting, infinite or inaccessible, the sea has become an infrastructure of our civilisation accounting for no less than 90% of world trade in goods, a productive environment on which billions of people depend for their animal protein intake, and even a remote place where, for some people, unwanted land activities, such as wind farms, can be conveniently located.

It is also, as EpE members are aware, an ecological infrastructure that regulates the habitability of our planet by absorbing some of the excess carbon dioxide, moderating the temperature of our regions, and housing part of the biodiversity on which we depend. Moreover, it is a huge ecosystem that attracts and inspires us, a once powerful and stable world that has now become vulnerable and priceless. Scientists are warning us about its rapid deterioration and the urgent need to curb acidification, preserve residual mangroves, marine ecosystems, and fisheries resources, and reduce the flow of waste accumulating on the seabed and in water.

Reconciling these sometimes competing or conflicting needs with the conservation of this environment calls for comprehensive governance, which has still some way to go. Indeed, while territorial waters and exclusive economic zones have been defined - conflicts notwithstanding - conditions for the protection and sustainable use of resources have yet to be established, particularly for the high seas. As the OECD has pointed out, the maritime world seems incapable of coping effectively with the many pressures on the ocean, governed as it has been until now by merely sectoral approaches.

Cross-cutting approaches to these issues, combined with voluntary action by business, are vital for preserving the health of the maritime world to which we are connected, and for ensuring that its riches are properly managed by our societies. This requires a double balancing act: between land and marine activities, and between long-term impact reduction and rapid economic development.

Businesses have developed solutions that can contribute to such more sustainable management, including on-land prevention of pollutant and plastic waste discharges, marine and coastal ecosystem restoration, spatial monitoring of vessel movements, fishing stocks and ecosystem health, infrastructure adaptation, decarbonisation financing, and coexistence of activities in some areas to reduce conflicts of use. They have started a dialogue with their value chains, the scientific community and their stakeholders to roll those solutions out on a larger scale.

This joint work has only just begun, but we felt it should be shared to spur adoption of best practices, broaden thinking in connection with ongoing negotiations, and inspire others. France is a major maritime power where stakeholders are well-placed to promote the sustainable management of these resources.

Jean-Laurent Bonnafé
Chairman of EpE
CEO of BNP Paribas

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Introduction

Healthy oceans - the cornerstone of human development

Infinite, impenetrable, invincible and unpredictable, the sea has always occupied in both mythology and modern adventure stories a special place in our imaginations and in the collective unconscious. Paradoxically, the importance of the ocean to our society has never been so tangible, its economic role so strong, and the challenges of its conservation so crucial.

The global economy is increasingly dependent on the ocean. Today, more than 90% of the international trade in goods passes through sea lanes. Major industries such as fisheries, tourism and shipbuilding depend directly on the services provided by the ocean. Other sea-based activities are growing at an exponential rate, including offshore energy production (especially wind), biotechnology, mineral extraction and aquaculture. This recent surge in activities that were all but non-existent a few decades ago shows to what extent exploitation of the ocean has soared. Today, the world has more than 16,000[1] desalination plants, over 1.2 million kilometres of submarine cables, and more than 16 million barrels of oil produced daily from deep-sea deposits. Europe already has 5,000 offshore wind turbines[2]. The OECD forecasts[3] that the value derived from the blue economy should double between 2010 and 2030 to more than US$3,000 billion, driven by the sharp increase in some maritime economic activities. In GDP terms, this would make the blue economy the world's fifth largest economy today. A BCG study for WWF points out that "marine GDP" had already climbed to an estimated $2,500[4] billion by 2015.

The services provided by the sea however, far exceed their economic and market value. Regulation of water cycles, mitigation of the effects of climate change through the capture of carbon dioxide and excess heat, production of half of the oxygen we breathe through photosynthesis of marine flora, supply of more than 20% of animal protein consumed in the world through its wildlife - these are only some of the largely irreplaceable services provided free of charge by the ocean. As with mining, the bulk of the value generated for the benefit of man comes from services provided for free by nature.

The ocean is deteriorating under the impact of climate change, of multiple kinds and sources of pollution, of overexploitation of its resources and services, and of biodiversity loss. The exponential increase in activity across many sectors has multiple environmental impacts. The ocean helps to regulate the climate by absorbing 22% of our greenhouse gas emissions annually. However, this is not without consequences: sea acidity has increased by 30% since the pre-industrial period and could triple by 2100[5], according to the IPCC. Marine biodiversity and thus ocean productivity are being hit hard by this change. Furthermore, overfishing and mangrove deforestation are affecting the balance of marine ecosystems. However, we need a well-functioning and prosperous ocean.

Although vital to humanity, the ocean has long received far less attention than it deserves. This paradoxical situation is partly explained by its specific complexities and features.

Some are related to its functioning:

- more than any other ecosystem, earth's seas are vertically and horizontally connected by physical and biological phenomena and long geochemical cycles;
- the ocean is not an environmental issue properly speaking, but a field where climate change, biodiversity erosion, resource overexploitation, and pollution are tightly intertwined.

1 https://www.cell.com/one-earth/fulltext/S2590-3322(19)30275-1
2 https://windeurope.org/about-wind/interactive-offshore-maps/
3 OECD (2016), The Ocean Economy in 2030, OECD Publishing, Paris, https://doi.org/10.1787/9789264251724-en
4 https://wwf.panda.org/wwf_news/?244770%252FOcean-wealth-valued-at-US24-trillion-but-sinking-fast
5 https://www.ipcc.ch/srocc/home/

Others derive from the relationship between people and the sea:

- until the mid-twentieth century, states paid little attention to their maritime territory, with national sovereignty exercised only over a small coastal area;
- the occupation and use of maritime areas by human activities are marked by multiple and at times overlapping uses;
- the fluid and dynamic nature of the ocean at times makes the regulatory, economic and sociological tools developed for land applications unsuitable;
- because of a combination of the preceding factors, the variety of players and the contiguity of areas which, while physically continuous, have different legal status, maritime governance is a highly complex issue.

The last few years have seen major advances. Greater attention on the climate-ocean link by the Paris agreement, the prospect of finalising an agreement at the United Nations on the governance of the high seas, the 2019 reports on the ocean and cryosphere by the IPCC and on biodiversity decline by IPBES, and the growing number of multi-stakeholder initiatives have helped push ocean-related discussions higher up national and international agendas.

Awareness is also growing among businesses. In 2018, Sustainable Development Goal 14 «Aquatic Life» was the goal that got the least attention in corporate reporting (see Figure 1). While progress appears to have been made in 2019, it remains one of the lowest priority SDGs. Several factors, all to do with the complexity of aquatic environments, contribute to this situation:

- **the dependence** of business activities on ocean services is very often ecosystem-based, and thus indirect and little known, especially by the vast majority of businesses whose activities are not primarily maritime;
- **impacts** are at times difficult to identify because they are usually indirect (e.g. water acidification due to global warming). Their diffuse nature, often involving a large number of stakeholders, also makes it difficult to implement efficient solutions;
- **internal organisation** can also prevent awareness because it addresses issues and data separately. Risks and opportunities are spread across various business activities and departments, so an Ocean Manager with a cross-cutting vision is seldom appointed by companies, unlike the case of climate or biodiversity issues.

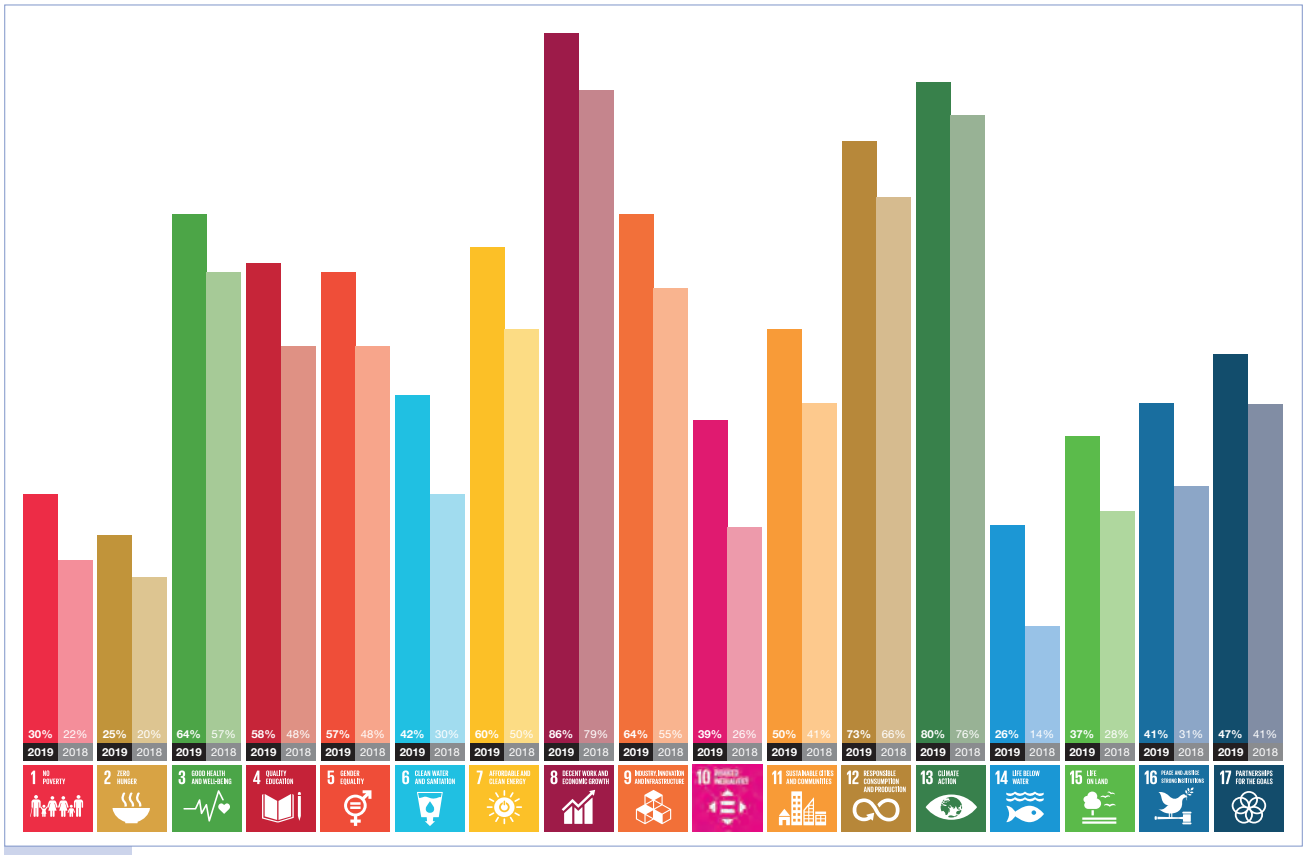


Figure 1

SDGs mentioned by businesses
Source: PWC's SDG Challenge 2019 (survey of 737 businesses).

Against this background of growing awareness on the one hand and methodological uncertainty on the other, EpE member companies decided to set up an Ocean Commission in 2018 to collectively explore those issues, share their experiences and best practices, and mutually enrich their environmental approaches.

Our publication collates their thinking - supplemented with additional insights from large and small businesses, scientists, public authorities, NGOs and financial players - and pursues three **goals**:

1. Raising awareness in the economic community and its stakeholders of threats to the stability of the oceans, and of solutions to reduce them.

2. Contributing to dialogue between maritime and non-maritime businesses and their stakeholders on the solutions and proposals advanced by them.

3. Demonstrating the existence of technological and organisational solutions whose widespread adoption can help restore a healthy and productive ocean.

Unlike many, this publication strives to jointly address environmental, economic and scientific issues, and to provide illustrations of many best business practices. While the issues faced by key economic sectors (fisheries, transport, energy, etc.) are considered, they do not structure the publication. A broad-based maritime approach has been adopted, reflecting the multiple issues and challenges faced.

The first chapter deals with «*Blue Acceleration*[6]», a term used in a paper by the Stockholm Resilience Centre to denote the rapid expansion of ocean-related economic activities and the risks this poses for the economic and ecosystem services provided. A well-functioning ocean is essential to the continuity of those services.

The second chapter discusses the vital role of scientific and technological knowledge in protecting the oceans, whether by contributing to decision-making or by monitoring the economic activities carried out by businesses.

In the third chapter, we discuss the development by business of known and innovative solutions to reduce the impacts of existing activities on marine environments.

The fourth and final chapter examines the arrangements enabling business to facilitate the coexistence of uses in the marine environment through consultation with sea users, voluntary cooperation between economic stakeholders, and participation in maritime spatial planning.

6 https://www.cell.com/one-earth/fulltext/S2590-3322(19)30275-1

1 Blue Acceleration-related societal and environmental challenges

A Fast-growing marine activities

Despite their role in the development of civilizations since time immemorial, maritime activities have until recently been mostly circumscribed to coastal areas. Increased individual consumption and exploitation of almost all land resources over the last few decades have coincided with the development of technologies for the exploration and use of marine resources. The resulting investments have driven economic growth, be it through the expansion of geographical areas available for use, through the efficiency of the different activities, or through their diversification.

Defining the **blue economy** accurately is a challenge in itself. It includes, first and foremost, activities carried out on the seas and coastlines (fishing, transport, offshore energy, coastal tourism, etc.), as well as activities using products and services of the sea (biotechnology, agri-food processing, etc.), and those providing products and services for exclusively maritime use (shipbuilding). These activities encompass practically every sector of the economy, including construction, financial services, and research and technology. Assessing the size of the blue economy, therefore, involves determining the maritime share of these activities and intermediate consumption in the maritime sectors.

The "Maritimisation of the Economy" survey conducted by BCG for the French Fondation de la Mer estimated in 2017 that, with over €270 billion in economic value and 820,000 jobs generated, the blue economy accounts for 14% of the French economy, i.e. more than automotive (~€100 billion) and aviation (~€50 billion). Ifremer had evaluated this share at 1.5% of GDP in 2013. While such differences in quantification stem primarily from assessment methods, for example of the maritime coastal economy's share, the growth in maritime activities is obvious. According to the European Commission's EU Blue Economy Report 2020, year-on-year job creation was up 10% in 2018, with the sector accounting for 5 million jobs and revenues of €750 billion in the EU.

The maritime economy may be described as a combination of traditional, emerging and cross-sectoral activities. The following sections describe the main characteristics, relative importance, development prospects, and environmental challenges of each activity.

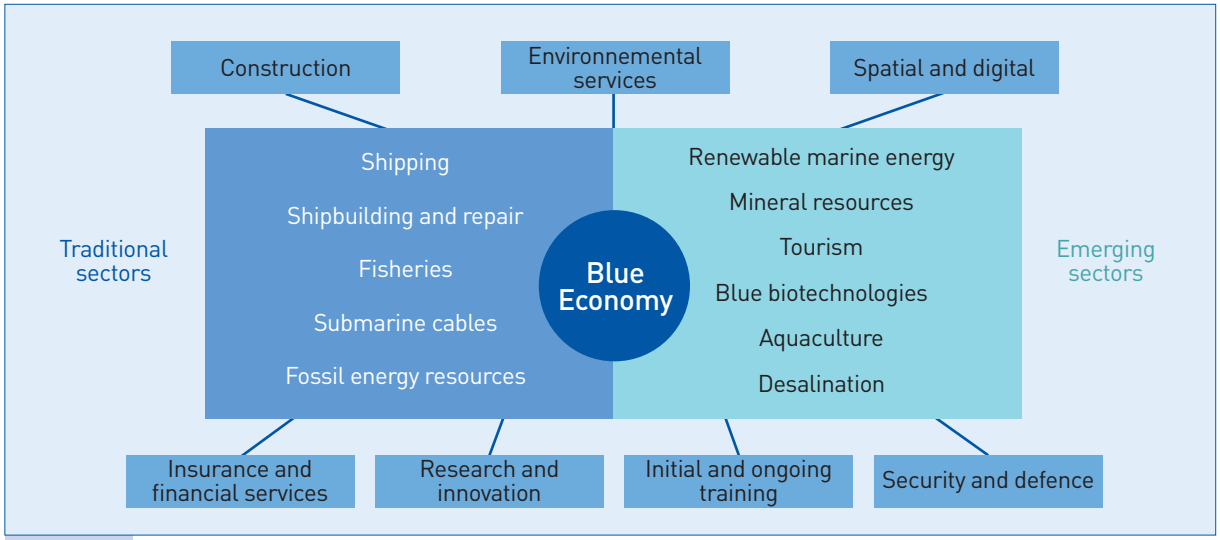


Figure 2 *Economic activities in the blue economy.*

1 - Traditional sectors

Since antiquity, the sea has been a source of provision and a means of transport. More recently, industrial revolutions have led to the emergence of other types of maritime activity.

- **Shipping**

In volume terms, 90% of world trade is transported by ship. As a result, the sector accounts for 3% of global greenhouse gas emissions. On the basis of the forecast increase in volumes of goods shipped, emissions could grow by anything from 50-250% by 2050, according to the International Maritime Organization (IMO). The OECD too has pointed out that the sector is responsible for many chemical and hydrocarbon discharges into both water and the atmosphere.

Like cargo ships, cruise ships have grown significantly in both number and size. Their proximity to remarkable, exceptional, and hence fragile areas such as Venice, the fjords and the Caribbean poses specific risks to those environments.

To decarbonise this sector, the IMO is committed to cutting greenhouse gas emissions by half between 2008 and 2050. The speed of fleet renewal and adaptation will be a key factor in avoiding emission lock-ins associated with the service live of vessels. Two tracks will be crucial: innovation in new engines and technologies (design, routing, speed, etc.); and production of low-volume, high-priced fuels (hydrogen, LNG, ammonia, electricity, agrofuels, etc.) with less - but not zero - environmental impacts.
To achieve this goal, the IMO believes approximately 50,000 ships would have to be decarbonised by 2050[7] and $50-$70 billion invested in the sector annually between 2030 and 2050. The complex and disparate international regulation of the sector, and the relationship between shipowners and charterers constitute challenges, if not obstacles, to achieving this transformation in such a short timeframe.

Large container ship sailing from Europoort, Rotterdam, Netherlands. ©Shutterstock

7 According to Statista Research Department, there were some 56,000 commercial vessels in circulation in 2020..

the first European label for voluntary environmental certification of sustainable maritime transport

Already committed to the protection of the oceans alongside its partner Surfrider Foundation Europe, Macif has been supporting since June 2020 the creation of the 1st European label «Green Marine Europe» for sustainable maritime transport emitting fewer greenhouse gases, avoiding pollution at sea and the proliferation of invasive plant species by ballast water. Macif is also investing in the «Ostreopsis Ovata» program to fight against the proliferation of this invasive seaweed along the Mediterranean, as well as in the «Plastic Origins» program which seeks to identify and quantify upstream the waste present in the rivers thanks to an application developed in particular by Microsoft. Mapping the pollution of watercourses makes it possible to offer solutions to local actors to fight against this plastic pollution of rivers that end up in the oceans.

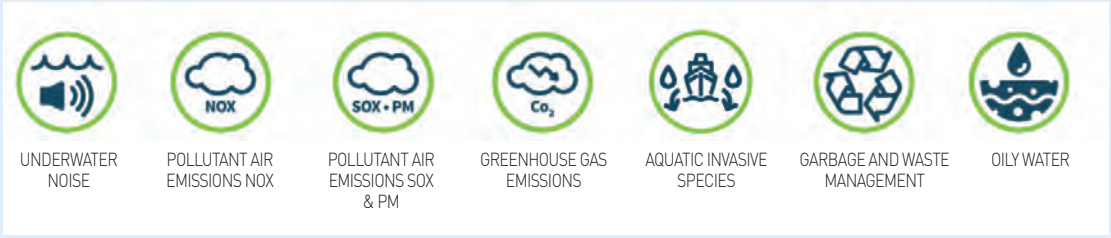
The Green Marine Europe Label

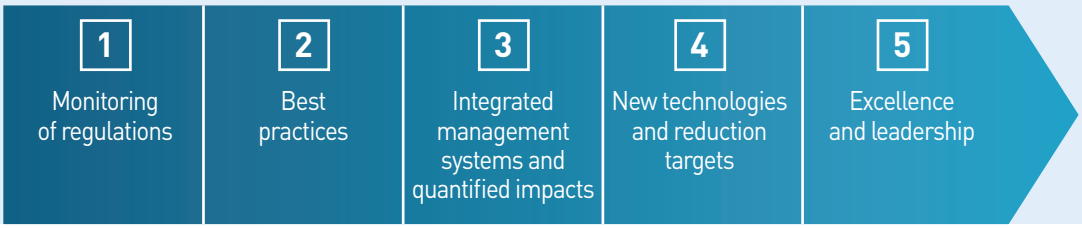
Its objective is to inform consumers about the environmental impacts of maritime transport and promote the practices of shipowners and shippers who have met the criteria of this label. SFE was inspired by the North American Green Alliance label, in order to create a device adapted to the European context. To implement its program, SFE has surrounded itself with several partners from the public and private sectors including Alliance Verte, ADEME, Macif, the Ministry of Ecological and Solidarity Transition and the European Union Life program.

The label's primary desire is to always go beyond existing regulations, to encourage shipowners to become more involved. The progress of the winners is assessed around 7 indicators (responsible ship recycling will be introduced in 2021), on a scale of 1 to 5, annually in the form of self-assessment and every two years by certified professionals. In order to acquire this label, shipowners must reach at least level 2 in one of the performance indicators and attest to a progress process by moving to a higher level on at least one performance indicator each year until they reach level 2 on all indicators.

In October 2020, for the first time, 6 shipowners obtained the label. Green Marine Europe works with French shipowners and maritime associations to develop the label.

https://allianceverte.org/green-marine-europe/





- **Shipbuilding and repair**

In 2020, the French shipbuilding industry posted sales of around €12.3 billion and employed 48,000 persons. The sector includes civilian and naval shipbuilding and repair, maritime equipment and marine construction. It does not include the manufacture of merchant cargo ships, only naval vessels and cruise ships.

Achieving the IMO's global fleet decarbonisation targets will transform the sector. The United Nations Global Compact (UNGC)[8] has identified several challenges and opportunities related to changes in the design, construction and adoption of new propulsion systems, hydrocarbon fuel substitution, and autonomous shipping. **Port infrastructure** will need to be adapted as well (greater energy charging capacity, for example), building on the changes already taking place (dock electrification, new fuel storage, etc.). All these issues will require considerable financial, human and material investment.

- **Fisheries**

With catches amounting to 171 million tonnes in 2016, compared to 165 million tonnes in 2014[9], worldwide fish production continues to climb. Because of the nutritional qualities of seafood products (proteins, omega-3, iron, zinc, calcium, vitamins A and B, etc.), FAO believes fishing offers an opportunity to ensure food security for future generations.

However, available stocks of fishery resources are threatened by fleet expansion, destructive fishing techniques, and illegal, unreported and unregulated fishing (IUU). FAO notes that the proportion of fish stocks exploited within biologically sustainable levels fell from 90% in 1974 to 66.9% in 2015, while the share of fish stocks caught at an unsustainable level rose from 10% in 1974 to 33.1% in 2015[10]. Fishing efficiency, defined as the effort required to catch one tonne of fish, is in sharp decline. Accordingly, the increase in investment this entails regularly triggers crises in the industry, resulting in continued government subsidies for the most industrialised fisheries. In 2019, only 15% of world production had the MSC label certifying sustainable stock management and reduced environmental impact of fishing activities.

- **Submarine cables**

99% of global telecommunications (internet and telephone) traffic passes through submarine cables. The development of this technology has facilitated the flow of information, trade and innovations. It plays a crucial role in economic and social development, and some sectors, such as finance, are highly dependent on it. Four countries have a global cable industry: USA, Japan, France and the United Kingdom. With the construction of Europe's power grid and the emergence of renewable marine energies, the electricity transmission network is fast spreading across maritime areas. The network at sea started with the installation of a subsea interconnector between France and England in 1986, followed by a second one in 2021. Other public projects are currently under development, including one in Spain (300 km between Bordeaux and Bilbao) and another in Ireland. However, by far the most important growth is that of offshore wind energy, which now plays a vital role in multi-year energy planning. The French Government, for example, intends to launch a new invitation to tender for a 1,000 MW offshore wind farm from 2023.

Because of their small spatial footprint, submarine cables have a moderate environmental impact[11]. The cable network has recently been expanded to bring offshore wind power to land.

Fishermen off the coast of Nabeul, Tunisia.
© Anastasia Palagutina on Unsplash

8 https://unglobalcompact.org/take-action/practical-guidances-for-the-un-global-compact-sustainable-ocean-principles
9 The State of World Fisheries and Aquaculture 2018, FAO. Achieving the Sustainable Development Goals http://www.fao.org/3/i9540fr/i9540fr.pdf
10 The State of World Fisheries and Aquaculture 2018, FAO. Achieving the Sustainable Development Goals http://www.fao.org/3/i9540fr/i9540fr.pdf
11 2016 Report of the United Nations Secretary-General on Oceans.

- **Fossil energy resources**

Thanks to the discovery of new deep-water deposits and the technological innovations that enable them to be exploited, offshore oil and gas production now accounts for one-third of global production. The sector faces a dual challenge: meeting growing global demand and transforming itself with a view to the energy transition, since the burning of fossil fuels is the main source of greenhouse gases. There is also the risk of stranded assets – deep-water drilling is particularly costly and platforms at the end of their life face an uncertain future.

Managing environmental impacts during the exploratory and operational phases, particularly in the event of loss of control, is a major concern for the industry. That is why plans to develop and locate new platforms can be controversial, particularly in the Arctic where melting ice is opening up areas that house 18% of the world's oil and gas resources, as well as off the South American coast where ecosystems are fragile.

View of the Al-Shaheen offshore field in Qatar, operated by the National Oil Company (a Total and Qatar Petroleum consortium). ©Roussel Marc - Total 2017

2 - Emerging sectors

Fast-growing human economies have led to the emergence of new maritime activities and the expansion of new land-based opportunities. These will at times compete with traditional activities for the occupation of maritime space and resource utilisation.

- **Renewable marine energy**

Renewable energy is one of the key solutions to reducing greenhouse gas emissions. According to experts from the Global Wind Energy Council, developing marine renewable energy or renewable energy at sea would help achieve nearly 10% of the required annual greenhouse gas reductions by 2050[12] required to keep global warming below the 1.5°C mark..

Currently accounting for 0.3% of global demand, the offshore wind industry has strong potential. The International Energy Agency forecasts a fifteen-fold increase in global offshore wind capacity by 2040. Offshore wind turbines have two to three times more capacity than their land equivalents[13]. Their cost has fallen from $150-$200 per MWh in 2015 to $100/MWh in 2017. The development of floating offshore wind farms driven by stronger winds and deployable in deeper waters will also boost production and reduce competition for the use of near-shore space.

The coupling of offshore wind farms with activities such as hydrogen production, fishing, aquaculture and desalination is generating mounting interest. Though still embryonic, multi-use platforms could help reduce conflicts of use, make more efficient use of maritime space, and generate new economic opportunities.

Renewable wave, current and tidal energy is also expanding, with wave energy jumping by 25% and tidal energy by 50% in 2019[14]. This type of power generation, however, has a number of drawbacks, including corrosion, regular maintenance, and limited end-use potential, with projects being profitable only in a limited number of areas (e.g. isolated islands). The unique features of the Rance dam, for example, are difficult to replicate.

12 The Economist Group's World Ocean Initiative, A sustainable ocean economy in 2030, 2020 https://ocean.economist.com/woi-sustainable-ocean-economy-2030/

13 Source EDF: https://www.edf.fr/groupe-edf/espaces-dedies/l-energie-de-a-a-z/tout-sur-l-energie/produire-de-l-electricite/l-eolien-en-mer

14 Ocean Energy Europe Report, Ocean Energy – Key trends and statistics 2019, March 2020 https://www.oceanenergy-europe.eu/wp-content/uploads/2020/03/OEE_Trends-Stats_2019_Web.pdf

A group of scientific experts to accompany an offshore wind farm

To ensure the best possible integration of the Dieppe Le Tréport offshore wind farm project into its environment, ENGIE and the other partners of Les Eoliennes en Mer Services created in February 2020 a Scientific Interest Group (SIG) Eolien en mer to accompany the wind farm and monitor the impacts of the offshore wind project. The objective of the GIS is to contribute to the improvement of scientific knowledge of the marine environment in the Eastern Channel and to disseminate this knowledge to the largest possible audience. Its research topics are the marine ecosystem, fishery resources, marine mammals, avifauna, acoustics, water quality...

The bodies of the SIG (Steering Committee and Scientific Council) are composed of various actors who bring a plurality of points of view: universities, public centres, environmental associations, private organizations. The activity of the SIG is planned for the entire life of the offshore wind farm, from its construction to the end of its dismantling, that is to say nearly 35 years.

The work carried out since the creation of the SIG has allowed the identification of three studies that will complement the mandatory environmental monitoring of the park and that will begin in 2021. First, five natural (i.e. non-urban) gull colonies will be surveyed to estimate the number of nests on them. This census will last at least 8 years and will be compared to the census of urban colonies. Next, DNA analysis will be performed on seal droppings, which will allow testing this technique to obtain additional information on the diet of these marine mammals. Finally, another DNA analysis will be carried out in plankton samples, to improve the knowledge on this compartment, especially on the presence of species at the egg and larva stage.

Two more important studies will also be the subject of tenders and will begin in 2022: a study on food webs (all food chains) and their evolution following the establishment of the park, but also on a larger scale concerning global warming; a study on bat populations and the evaluation of possible migrations to England using genetic and acoustic tools.

© ENGIE

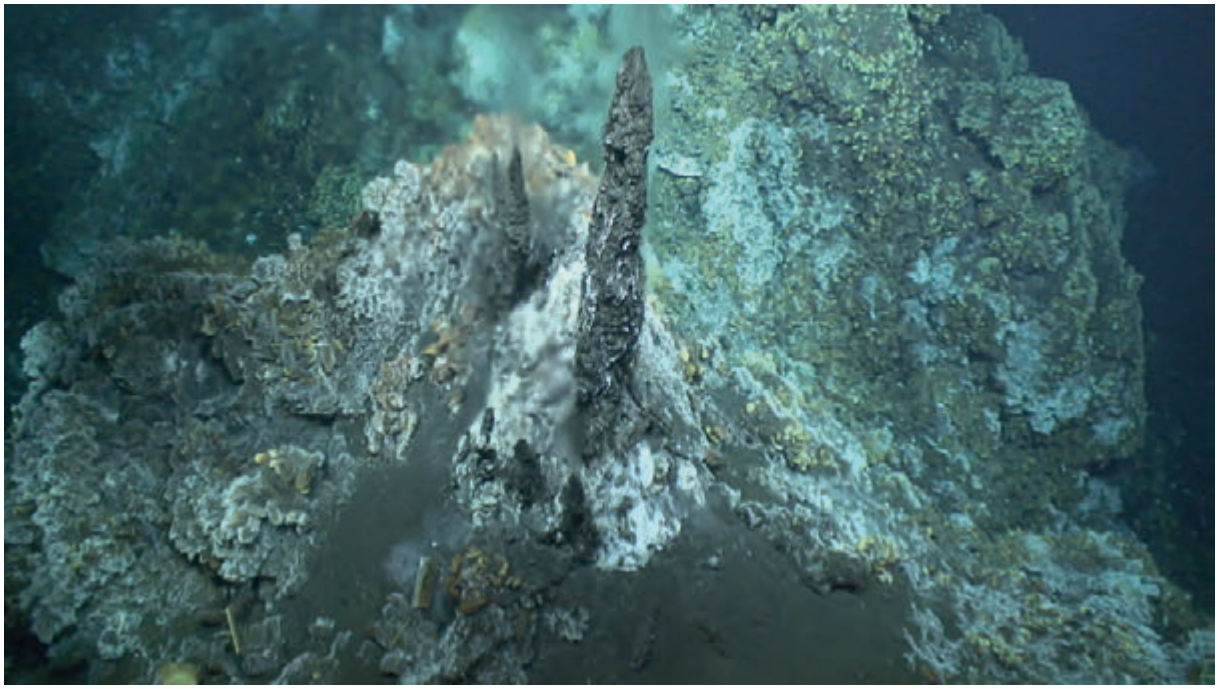
- **Mineral resources**

Among metallic mineral resources, rare metals (rare earth, copper, zinc, cobalt, lithium) are increasingly sought after since they are essential to the development of new technologies, in particular renewable energy, electric mobility and digital systems. The World Bank in its "Minerals for Climate Action" report estimates that production of these minerals could soar 500% by 2050[15].

Given the growing demand for rare metals, unevenly distributed or limited land reserves are the cause of many geopolitical and environmental tensions. To meet the need for rare metals, the seabed might offer significant opportunities, particularly through the exploitation of cobalt crusts and polymetallic nodules. The French Maritime Cluster estimates that marine minerals' share of world production could rise to 10% by 2030.

The exploitation of these resources has yet to begin, although since 2001 thirty exploration permits have been awarded by the International Seabed Authority, the agency responsible for international waters, in addition to the various national permits[16]. Developing this activity will face technological, financial and environmental challenges arising from the difficult operating environment. There are also considerable uncertainties about the activity's environmental impacts and the issue of profit-sharing.

Non-metallic mineral resources, aggregates, sands and gravels are mainly used for construction activities near ports, with the proximity of deposits being an essential criterion for profitability. In France, a study by the *Conseil général de l'économie* estimates marine aggregate output at 2% of land-based production, with limited environmental impacts[17]. Since these activities usually occur in coastal areas, consulting with other maritime stakeholders operating in the same area is a sensible policy, as exemplified by GSM.



Lucky Strike hydrothermal site located at a depth of 1,700 m and home to several springs, known as black smokers, which spew water at 350°c and have high concentrations of sulphur and heavy metals. ©IFREMER (2015). https://image.ifremer.fr/data/00565/67746/

15 World Bank, Minerals for Climate Action: the Mineral Intensity of the Clean Energy Transition, 2020 https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action

16 https://www.nature.com/articles/s41893-020-0558-x

17 Environmental and economic impact of marine mineral exploration or exploitation activities, CGE, December 2017 https://www.vie-publique.fr/rapport/126797-exploration-ou-exploitation-des-ressources-minerales-marines

Consultation to ensure co-activity with other users of the sea

Aggregates (sand, gravel), produced as close as possible to demand, come from exploitation of both on shore and fluvial deposit offshore, and from the recycling of demolition concrete.

To meet the needs of coastal regions for local construction materials, GSM uses marine aggregates.

Consultation to maintain the co-activity of uses, a GSM commitment on the Eastern Channel Coastal region.

Marine exploitation must be respectful of the environment and respect the activities already present. However, the Bay of Seine includes numerous activities likely to come into conflict over the use of space (navigation channels, piling, wind farm, fishing). GSM and its partners have therefore launched an appropriate consultation process to jointly define with the players the conditions required to allow co-activity.

Conducted before submitting the concession file, through 60 bilateral meetings, 7 workgroups, 9 consultation unit meetings with over 300 people, representing the various economic stakeholders (port, fishing, wind farm activities, etc.), administration, local communities, environmental and leisure associations, the consultation made it possible to define the environmental stakes, build the contours of the future extraction zone and determine the exploitation procedures acceptable for all stakeholders. The result of these collaborative exchanges was converted into exploitation procedures specifying, for example, the suspension of activity during scallop fishing in the Bay of the Seine, the division of the concession into strips of approximately 1 km^2 to allow other activities to continue over an area as large as possible, as well as the phasing of the exploitation to allow natural recolonisation after exploitation, promoting the continuity of the fishing activity.

In addition, the exploitation is monitored to check in particular the impact on the fisheries resource and the results are presented to the stakeholders, including the fishing activity, during consultation units. This open dialogue with the stakeholders throughout the life of the concession (30 years) will secure the conditions for co-activity.

- **Tourism**

According to the United Nation[18], tourism generated 7% of world trade in 2019, and employed one in ten persons worldwide. The Covid-19 crisis has highlighted the weaknesses of the sector, which is also under threat from climate change. Rising sea levels and the increasing number of extreme weather events have a strong impact on seaside tourism which, in some small island developing states such as Seychelles and the Maldives, accounts for up to 25% of national GDP.

The sector also has a direct environmental impact. According to WWF, 52% of waste found in the Mediterranean Sea is related to seaside touris[19], in addition to transport emissions and land-take from the development of infrastructure and urbanised areas.

From waste and plastic reduction, through improvements in energy efficiency of infrastructure, to supply of local and sustainable products, developing eco-tourism is key. Over time, the sector could play a positive role in the protection of marine and coastal environments by becoming a source of funding for their protection.

Tourism is a significant economic sector for many regions, and can contribute to the conservation and development of coastal areas. © Lena Varzar on unsplash

18 UN, Covid-19 and Transforming Tourism, 2020 https://www.un.org/sites/un2.un.org/files/policy_brief_covid-19_and_transforming_tourism_french.pdf

19 https://www.wwf.fr/vous-informer/actualites/la-mer-mediterranee-une-richesse-unique-en-declin-rapide

- **Blue biotechnologies**

Rich in organisms (sponges, algae, worms, etc.) and micro-organisms, the oceans offer amazing opportunities to the biotechnology sector. Multiple applications are derived from the exploitation and transformation of marine living resources using technological processes, particularly in the fields of health, cosmetics, the environment and energy. According to Ifremer, blue biotechnology will see *"6-8% annual growth over the next five years, and annual revenues rising above the billion-euro mark"*[20].

Some 30 million tonnes of marine algae are currently produced every year, mainly in Asia[21]. As well as playing a fundamental role in balancing marine ecosystems and capturing and storing carbon dioxide, algae and microalgae have a host of industrial uses. They are employed in aquaculture and agriculture, as well as in the production of cosmetics, packaging materials and fuels (algofuel). According to Ifremer, they would also have an energy yield ten times higher than that of terrestrial oilseeds (rape, palm oil, etc.). This resource could therefore be instrumental in the fight against climate change. Several international initiatives have recently been launched (*Safe Seaweed Coalition, Seaweed for Europe*) to harness this widely untapped potential. However, technological setbacks (filter clogging) have so far prevented widespread development of these new energies.

Organisms and bacteria living in the oceans may also have pharmaceutical and medical uses. In the context of Covid-19, the French pharmaceutical laboratory Hemarina has used the haemoglobin properties of the marine lugworm to develop treatments for the acute respiratory distress syndrome.

- **Aquaculture**

According to FAO, aquaculture grew by 5.8% a year during the 2000-2016 period. In 2016, output reached 80 million tonnes, or 47% of total fish production. Since 1991, China has been world leader in fish farming.

Growth forecasts for aquaculture remain bullish because it could meet the challenge facing the fishing industry of the sustainable management of fish stocks in the face of growing demand for protein. In FAO's view, aquaculture capacity could meet the triple objective of smart agriculture: increased productivity, climate change adaptation, and greenhouse gas emissions reduction.

In order that aquaculture meets the demand for fish in a sustainable manner, the sector must free itself from its dependence on wild fish (via industrial anchovy and sardine fishing) to produce 30% of the feed given to farmed fish. The sector is increasingly turning to soy beans, biotechnologies (insects, algae, etc.) and even laboratory-produced fish, the market for which is expected to grow to $600 million by 2032.

Pearl oyster aquaculture at Tahiti's Centre Ifremer. Photo Caisey Xavier

20 https://archimer.ifremer.fr/doc/00414/52540/53353.pdf
21 https://unglobalcompact.org/take-action/practical-guidances-for-the-un-global-compact-sustainable-ocean-principles

- **Desalination**

Like wastewater reuse, desalination is an alternative source of fresh water that should form part of a wider water conservation and safe drinking water supply strategy. There are two desalination technologies: thermal and membrane. The energy consumed by these processes has been halved in 20 years, and an additional 25% saving is expected in the medium term thanks to membrane innovations. Specifications increasingly require linkage with renewable energy sources. The Global Clean Water Desalination Alliance "H_2O minus CO_2"[22] launched at COP 21 brings together key manufacturers and operators.

3 - Cross-cutting sectors

The sea economy is not just limited to maritime and partly maritime activities. The development and operation of the above activities are guided by other sectors which, though not dedicated to the ocean, extend and transfer their ordinary activities to it (e.g. finance, research, insurance). Support from these cross-cutting sectors will be crucial. Depending on the form this takes, the ocean will be more or less impacted. It could even be enriched with new functions. For example, wind farms could serve as artificial reefs and fish spawning grounds with bespoke design from the outset. The earlier the awareness of the specificities of the marine environment, the better the knowledge is brought to bear.

- **Construction**

The construction sector plays an essential role in the smooth functioning of the blue economy through the building and maintenance of port, offshore and coastal infrastructure. Like many sectors, a major challenge facing construction is reducing the impact of its activities on aquatic and coastal environments by developing less polluting materials and restricting land use.

- **Insurance and financial services**

The strong need for capital could be leveraged by financial stakeholders to steer sectors in a sustainable direction (Blue bonds).What methods they use to prevent and manage the natural and economic risks faced by the various stakeholders of the blue economy will be a factor in ensuring the long-term viability of those activities.

- **Environmental services**

Water, energy and waste management are essential to marine ecosystem quality. Conservation of the oceans means changing practices on land, because the ocean sooner or later receives everything rivers bring to it, along with everything people on land no longer want. The scope of these activities is very wide and encompasses, in particular, the construction of water treatment plants, the treatment of industrial effluents and urban waste, and clean-up operations.

Hosing of riprap following an oil spill. ©Séché

- **Space and digital**

In conjunction with the digital sectors, the space sector already plays an important role in providing detailed knowledge of the state of marine ecosystems, the impact of human activities (on reefs, for example) and climate change (sea level rise, forecasts and alerts, etc.). The Topex-Poseidon system, for instance, allows sea and ocean levels to be measured with centimetre accuracy. Space and digital technologies would also facilitate the development and monitoring of new activities.

Artist's view of the Sentinel-6 satellite. © Nasa

22 http://climateinitiativesplatform.org/index.php/Global_Clean_Water_Desalination_Alliance_(GCWDA)

- **Research and innovation**

New technologies for exploiting more marine resources, reducing related impacts, and increasing knowledge of the seabed are attracting considerable public and private investment. Scientific research plays a vital role in *Blue Acceleration*. Exploitation will have more or less irreversible impacts depending on whether R&D focuses on exploitation or on sustainability.

- **Initial and ongoing training**

Change in jobs and skills is both a condition for and a consequence of the transformation towards a sustainable blue economy. In France, the maritime economy could account for up to 1 million jobs by 2030. Meeting these challenges will require the sometimes difficult transition of unsustainable trades, and the training of current and future generations in new processes and trades. This includes the reconversion of highly predatory fishing practices, and the transformation of the petroleum sector to promote the development of offshore wind farms and underground CO_2 storage facilities.

- **Security and defence**

Land claims, free circulation, protection of information infrastructure and transfer, and maritime resource access and sharing are all issues of geopolitical and commercial importance. They are accompanied by government investments in defence, monitoring and control equipment and services, usually on a remote basis

Automatic oceanographic platform in the Gulf of Trieste. ©Shutterstock

In short, all sectors, cramped as they are on the mainland and keen to access the benefits of globalisation and seashore amenities, are expanding their operations on water and the ocean, driven by the perception that it is a freer space than land, where occupation has almost reached saturation point and transportation costs are higher. In France, for example, the population has been concentrated over the last 100 years within 100 kilometres of the coast.

For many trades, the prospects for transitioning to the maritime environment seem bright. How far can human expansion go before the ecological balance collapses? And how do we conserve the essential ecosystem services we take from the ocean?

Defining a shared vision by 2050 of innovative energy models for climate

In the current state of technologies and business models, the 2050 National, European and International objectives of carbon neutrality and greenhouse gas reductions are impossible to achieve for several maritime uses. We need a deep transformation of our energy models to reach the Climate goals and the «1,5°» Target of the Paris Agreement. The challenge is to synchronise the efforts of the whole of the value chain, from sea, river, coastal and port activities to shore activities, keeping the connexion with the territories in a door-to-door approach.

The Coalition for the Maritime Eco-Energy Transition (MEET) launched in December 2019 with the French President, aims to collectively create a vision of energy models that will make it possible to achieve these objectives in an intersectoral and cross-industries approach. These models are based on a complete analysis of the energy mix - energy efficiency - biodiversity, taking into account technological, economic, infrastructure, services and regulatory issues. The transition is driven by five elements:

- **The specificities of the many uses addressed and fleet segments** targeted with very varied «technical - energy - operational profiles».
- **Possibilities of mutualisation** because some of the key technologies could be shared between maritime players and with players from other sectors, to reduce costs and accelerate innovation.
- **Continuity between fossil - low carbon – zero carbon fuels and techno-energy hybridisations.** Some uses can be pioneers while others do not yet have solutions to decarbonise their mix. The transition is a pathway of progressive, technological and economic changes with existing solutions and innovations that must be created and accelerated.
- **The coherent construction of energy supply chains** to offer sufficient volumes of alternative energies and technologies at competitive costs. Ports are becoming multi-energy hubs where transformations of the entire logistics-mobility chain are concentrated: river, road, rail and territories.
- **The energy transition goes hand in hand with digital transformation**. From data tools especially for energy management to digital twins, precise knowledge of energy systems, emissions monitoring, impact calculations and operation optimization are possible with digital.

The Coalition focuses on three workstreams:

1. Defining trajectories and developing tools to measure the impacts of the new energy models solutions;
2. Defining operational ambitions following the «0 emission» initiatives to stimulate innovation;
3. Creating a dedicated «Lab» to synchronize R&D, studies and projects and to animate an innovation ecosystem in an international dimension.

A digital platform is under construction and will be presented in september 2021 with three systems: information, decision making and collaboration, to accelerate, synchronize and finance the energy models innovations.

B The ocean's multiple contributions to social well-being

Marine and coastal ecosystems are home to many animal and plant species that contribute directly or indirectly to human well-being. These nature-derived benefits are called ecosystem services, and their quality and quantity are dependent on the state of our marine and coastal ecosystems. Human actions can have a detrimental or beneficial impact - directly or indirectly - on chemical, biological and physical processes in the marine environment.

Traditionally, there are three types of ecosystem service:

1 - Provisioning services

The oceans have many resources that can be directly used to meet human needs. They include food (fish, crustaceans, etc.), biological matter (cosmetic inputs, molecules of pharmaceutical interest, etc.), energy (oil, gas, etc.), and minerals (sands, aggregates, rare metals, etc.). These products and services are usually given a direct monetary value on markets, but such a valuation does not include any "remuneration" of nature - only the human recovery work (fishing, harvesting, exploitation) is paid, accompanied at times by a scarcity premium similar to the mineral premium where the authorised quantity is limited (fishing quotas). The main threats to these services are overexploitation, such as overfishing, and chemical or physical pollution that can threaten entire local or global ecosystems (e.g. acidification, large-scale warming, even noise from human activities). At sea as on land, there are conflicts of use and competition between small-scale and industrial fishermen, between fishermen and energy providers, between pollution and resource harvesting, or between territory and time of use. Governments resolve such conflicts in areas under their control through licensing and concessions, but conflicts on the high seas, or even conflicts between the high seas and national maritime areas, are more difficult to resolve by legal means.

2 - Regulating and maintenance services

Well-functioning marine ecosystems enable regulation of natural processes (water, carbon, calcium cycles, etc.) that are degraded at times by anthropogenic activities. The Gulf Stream, for example, provides a valuable service by keeping Europe's climate mild and moderate. Another service is limitation of the effects of excess greenhouse gases in the atmosphere through oceanic capture of atmospheric CO_2 and 93% of the excess heat generated by human activities. On coastlines, mangrove forests contribute to protection from rising sea levels and erosion by retaining soil between their roots and mitigating the damage caused by waves, as well as to conservation of fauna and flora. Under the combined action of physical (sun, salt, etc.) and biological factors (micro-organisms), the sea removes air and water pollutants and even pathogens, thus helping to protect the health of coastal populations and safeguard economic activities. Marine ecosystems are also areas of refuge for many species that breed and feed in their waters.

«All IPCC scenarios predict rising sea levels compared to the 1986-2005 period», EpE publication. World Bank – Dominica

3 - Cultural and recreational services

The oceans not only offer a host of resources; they also provide landscapes and recreational spaces appreciated by the people who go there to engage in recreational activities, cruises, sports and cultural activities. In doing so, they not only contribute to local or distant economic and social development, but also create pressures on ecosystems.

As well as fostering a sense of the infinite and the unknown, the sea and marine biodiversity provide intangible services, such as educational materials, religious symbols, and artistic inspiration. The beach and the sea are essential elements of our memories and our unconscious!

Jeremy Bishop on Unsplash.

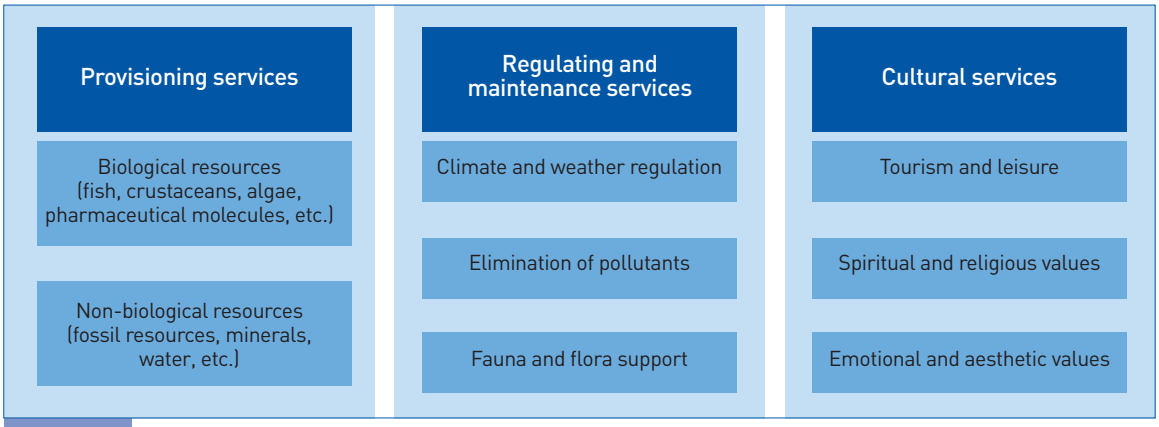


Figure 3

Ecosystem services provided by the ocean. Source: UE Blue Economy report 2020, p. 55.

All these services are based on the operation of the ocean ecosystem and its various local environments, as well as the interactions between those local systems – all of them through water – and their highly complex and still poorly understood dynamics. However, generating economic and social benefits depends on how well these ecosystems work, as illustrated by the iconic case of tourism, which depends on several ecosystem services.

Assessing the economic value of ecosystem services in order to include them in decision-making processes is a complex exercise and the focus of many scientific studies and ongoing efforts of research teams. Their global value is estimated at over $24,000 billion annually, or more than US GDP[23]. This figure should however be treated with caution, due in part to the lack of a comprehensive assessment of marine ecosystems, and in part to the methodological choices on which such a valuation is based. Exercises of this kind, though undoubtedly a matter for debate, could eventually form the basis for decisions. Quantifying the positive economic impact on fisheries or tourism, for example, is an important factor in the decision to establish protected marine areas.

C The ocean under pressure

The importance and value of ecosystem services are dependent on ecosystems being healthy. The health of ecosystems, however, is declining rapidly as a result of various pressures, such as climate change, multiple pollution (including that caused by plastic waste), overexploitation of fishery resources, and other indirect pressures (disturbance of physical and biological processes, land-take, etc.).

The ocean, used until now as an "infinite larder and a bottomless toilet", is under multiple direct and indirect pressures that scientists today believe surpass what natural regeneration can offset.

1 - The climate crisis

The ocean-atmosphere connection is the source of climate science. Winds cause movement of the ocean surface and the warming of surface waters is one of the engines of thermohaline circulation. Of the 40 billion tonnes of annual CO_2 emissions generated by human activities, 43% are stored in the atmosphere, 29% in vegetation and 22% are captured by the ocean. This 22% is not without impact, because the dissolution of CO_2 in water contributes to the formation of carbonic acid which promotes water acidification. As a result, water acidity has risen by 30% since the pre-industrial period and could triple by 2100.

23 WWF, Reviving The Ocean Economy – The case for action - 2015
https://www.worldwildlife.org/publications/reviving-the-oceans-economy-the-case-for-action-2015

To understand these impacts in detail, and following the 2015 Paris Agreement, the United Nations Framework Convention on Climate Change (UNFCCC) commissioned the IPCC to draw up a special report on the ocean and cryosphere in the context of climate change. Validated on 24 September 2019 in Monaco, the report covers both the ocean and the cryosphere - i.e. water stored in glaciers, pack ice, snow and permafrost - because of the scale of material and heat exchanges between them. 104 authors examined nearly 7,000 studies and replied to more than 30,000 comments.

The main conclusion of the report is that climate change has already significantly affected the functioning of the ocean and the cryosphere. The associated effects (marine heatwaves, acidification, oxygen loss, melting of ice sheets, sea level rise) will in turn affect ecosystems and human populations. The report highlights the benefits of ambitious and effective sustainable development action and, conversely, the ever-increasing costs and risks of inaction, depending on the systems concerned:

- **Ocean and marine life**

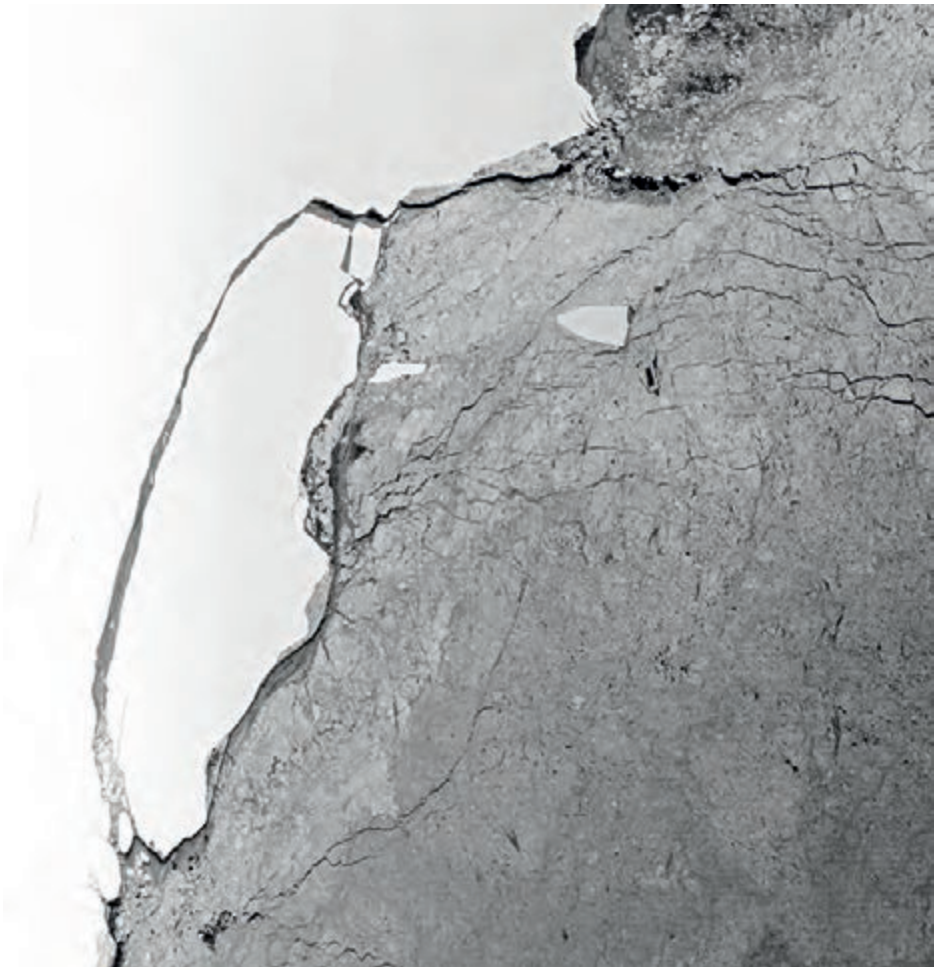
increased water stratification caused by warming slows exchanges between the upper layer (surface waters up to 50-200 m), where photosynthesis occurs, and the lower layer, which is a nutrient reservoir for organisms living in the former. This has manifold consequences for marine life. Between 2009 and 2014, the Great Barrier Reef lost 50% of its surface area due to bleaching episodes caused by an increase in water temperature. Mangroves will lose between 20% and 90% of their surface area by 2100 due to human activities and the effects of climate change. Fish species are migrating. Some are appearing in polar areas; more significantly others are disappearing from tropical areas where subsistence fishing remains a key activity.

- **Coastal areas**

all IPCC scenarios predict sea levels rising from the 1986-2005 period by between 0.43 m and 1 m by 2100, and between 1 m and 5.4 m by 2300. Combined with the action of cyclones, this rise will turn 100-year events into annual events. Coastal cities in tropical countries are particularly at risk.

- **Polar regions**

indigenous populations have already had to adapt their lifestyles. Ice melt is three times faster than previously forecast, leading to a revision of sea-level rise forecasts, with melting ice now the primary factor ahead of thermal expansion of water.



Satellite image of crack in the Larsen ice shelf in Antarctica.
© Airbus Defence and Space GmbH 2017

Proposing together local solutions for the mangrove restoration

In Martinique, SUEZ Consulting and the Agglomeration municipality of the center of Martinique reconcile the preservation of biodiversity and economic activities by promoting the development of mangroves.

In Martinique, close to the "Etang Z'Abricots" marina in the Fort-de-France Bay, more precisely at the Pointe des Sables, the mangrove is a critical component to adapt to climate change.

SUEZ Consulting, with the support of the Biodiversity French Office in partnership with the Agglomeration municipality of the center of Martinique and the experts of the University of Antilles, realized in 2020 a feasibility study focus on the mangrove growth to protect the marina. The teams defined the technical, financial, required, and ecological terms, necessary to characterize the project and its site (the mangrove, current patterns, and the sedimentary dynamics) to propose a technical solution in collaboration with the local and regional stakeholders.

This step approved the feasibility of the project, before the operational work which begins this year, and the ecological and sedimentary monitoring which will last until 2026.

The operational phase is included in the demonstrator program LIFE ARTISAN, a European project, 60% funded by the European Commission and piloted by the Biodiversity French Office, with the support of 29 partners. It participates in the implementation of the Climate Change Mitigation Development Plan.

SUEZ Consulting teams designed a solution enhancing sedimentation on a sandy point close to the marina entrance so that the mangrove can grow. Over time, it will act as a natural and resilient block to protect the marina against the agitation of the sea.

This Nature-Based Solution is a true ecological engineering and innovative operation aiming to:

- Defined basics for a sustainable, resilient, and ecological approach to protect the marina.
- Prove that biodiversity protection and economic activities are closely linked.

2 - Pollution

Human activities generate many types of waste, some of which finds its way to the ocean. While some waste is of maritime origin, such as wash water from scrubbers which, after filtering exhaust gases from ship engines, can contaminate marine environments during open-loop operation, the bulk (some 80%) of it is from land.

Almost all water-consuming human activities discharge **wastewater**. The components of wastewater are determined by the origin of the waste - domestic, industrial, agricultural or runoff. They include organic and pathogenic materials of human origin, agricultural nutrients and pesticides, emerging pollutants (pharmaceutical and drug residues, endocrine disrupters), mined heavy metals, and landfill chemicals. While high-income countries treat 70% of their wastewater, the rate falls to 8% in low-income countries. Globally, it is estimated that more than 80% of wastewater is discharged into rivers without being treated[24], and ends up in the sea.

The discharge of untreated or poorly treated wastewater (contaminated or disease-carrying water) can have adverse effects on human health, and negative impacts on the environment (eutrophication from farm sources caused by excess nitrogen can cause algae proliferation and biodiversity loss) and economic activities (lower fishing catches and tourism revenues).

After examining nearly 600 studies, Boston College and the Monaco Science Centre[25] highlight the effects of ocean pollution on human health, including contamination of food chains with mercury released from coal combustion and ever higher levels of algal toxins produced by wastewater discharges. The most affected areas are the Mediterranean Sea, the Baltic Sea and Asian rivers.

24 UN World Water Development Report 2017.
25 Human Health and Ocean Pollution, December 2020 - https://doi.org/10.5334/aogh.2831

The solutions to these problems are twofold: pollution reduction and prevention at source (e.g. by limiting the use of polluting products), and wastewater collection and treatment. In any event, it will be necessary to monitor and track discharges so as to measure the effectiveness of the solutions rolled out.

Plastic pollution is not the only type of pollution to hit the oceans, but it is perhaps the most symbolic. Lightweight, resistant and cheap, plastics are being produced in ever greater numbers since the second half of the 20th century. Annual production is 400 million tonnes, with half of the aggregate output produced since 2000. The effects of the 8 million tonnes released each year into the sea remain poorly understood, as does the fate of those plastics.

As well as posing a direct threat to marine mammals, birds and fish in the form of physical harm, suffocation or obstruction, plastic waste at sea breaks up, facilitating its ingestion by marine organisms, and consequently its penetration into food chains. While there is so far no consensus over the effects, the toxicological risk to human health and ecosystems is acknowledged as being based on various chemical pollutants which are used in the composition of plastics, or become attached to them during their stay in water. Then there are the biological risks, whereby plastic debris serves as rafts for pathogens and invasive species, facilitating their movement between different marine ecosystems.

Fondation tara océan explorer et partager

Reducing our use of plastic and promoting the circular economy

Tara's missions across the world's oceans have repeatedly revealed the omnipresence of plastic waste. Accumulation of plastic in nature is one of the most widespread and lasting changes to the surface of our planet. It poses a threat to the entire chain of life, and thereby to the balances that make good health and human activities possible. The abundance of tiny fragments smaller than 5 mm, called microplastics, makes impossible the notion of «cleaning up» the oceans. This was clearly shown by discoveries made aboard the research schooner in 2019.

Samples taken from 9 of the major European rivers reveal that plastic pollution is omnipresent in micro-fragmented form. From cities and countryside via rainwater pipes, sewers, rivers and streams, plastics reach the sea, contaminating all ecosystems in passing. The predominantly terrestrial origin of marine pollution means that solutions to the problem are definitely to be found on land. Polymorphic, ubiquitous, and often irreplaceable, plastics occupy a major place in our societies that can not be compared to any other material. The imperative to stop dumping plastics in nature is proving to be a highly complex challenge. About 100 million tonnes are dumped into nature per year, and current systems of waste collection will be inadequate over the long term. We are thus obliged to drastically reduce our use of plastics. As for those deemed essential, their non-toxicity will have to demonstrate, as will their ability to be collected and effectively recycled. Reduce, reuse / repair, recycle are indeed the pillars of a new economic model described as circular which cannot be reduced to simply recycling or replacing plastic with other materials that might have other negative impacts on the environment. This new economic model would ensure that respect for living things and the preservation of resources are prerequisites. This new paradigm will be THE engine of innovation around which a new business model will revolve, finally reconciling humanity and its environment.

To go further:
https://oceans.taraexpeditions.org/

3 - Other pressures and biodiversity loss

Climate change and pollution pose serious threats to the proper functioning of marine ecosystems, as do overfishing and changes in land, sea and coastal use caused by infrastructure and aquaculture development. Similarly, the increasingly global scale of cargo shipping facilitates the introduction and spread of invasive alien species, which directly impact food security and potentially human health.

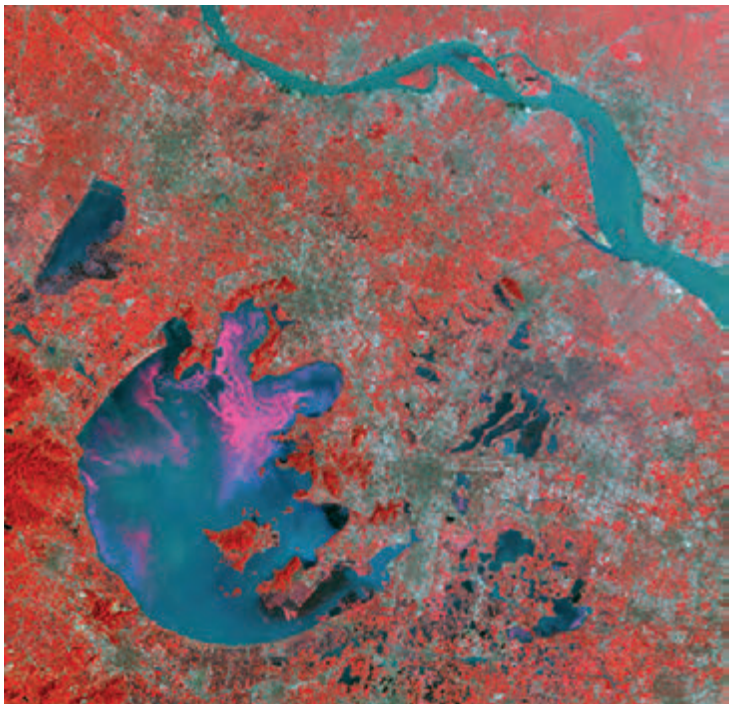
Often described as the "IPCC for Biodiversity", the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is an independent intergovernmental body comprising more than 130 Member States. In 2019, it released the first intergovernmental global assessment report on biodiversity and ecosystem services, which is the most comprehensive survey to date, with 15,000 scientific references and government sources, and over 450 experts from 5 countries taking part. It warned that "nature is declining globally at rates unprecedented in human history - and the rate of species extinctions is accelerating, with grave impacts on people around the world now likely".

The report estimates that as things stand about one million animal and plant species are threatened with extinction in the coming decades, at a rate never before seen in human history.

Its main conclusions regarding marine ecosystems are:

- nearly 33% of coral reefs and more than one-third of all marine mammals are endangered;
- about 66% of the marine environment has been significantly altered by human action;
- 100-300 million people are at increased risk of floods and hurricanes due to the loss of coastal habitats and their protection;
- in 2015, 33% of marine fish stocks were exploited at unsustainable levels; 60% were exploited at the maximum level of sustainable fishing, and only 7% below levels estimated as sustainable
- plastic pollution has increased tenfold since 1980. 300-400 million tonnes of heavy metals, solvents, toxic sludge and other waste from industrial sites are discharged annually into the world's waters. Fertilizers that arrive in coastal ecosystems have created more than 400 "dead zones" in the oceans covering about 245,000 km^2, an area larger than the UK.

The *Fondation pour la recherche sur la biodiversité*, the French equivalent of IPBES, notes and highlights several recommendations of the IPBES report on strengthening international oceans governance, in particular effective enforcement of shipping conventions, inclusion of, and adaptation to, climate change in ocean governance, and improved inter-state cooperation to ensure compliance with existing conservation mechanisms.



Blooms in Lake Taihu, China.
Algal blooms are rapidly spreading algae which can be caused by nitrate and phosphorus pollution.
©Airbus Defence and Space Ltd. trading as DMCii

2 Enhancing knowledge to better protect, measure and manage

As economic activity increases, marine ecosystems and the essential services they provide face ever bigger risks. Our knowledge of ecosystems and their interactions with each other and with human activities remains limited. This chapter shows the value of better scientific knowledge of the oceans, whether through public scientific research or business-led activities. However, scientific investigation is not without risks. Any intrusion into these fragile and already vulnerable spaces, even for the sake of knowledge, would open the way to a more invasive human presence, even exploitation, and so would pose a potential threat to the wildlife they contain, especially in the absence of global governance of that vast space.

A An unlimited field of research

The ocean remains a big mystery to this day. Its sheer size and the problems of accessing it largely explain this lack of knowledge.

Only 19% of the seabed is mapped today. There remain vast expanses, including the deep ocean and polar areas, whose marine species and processes we know little about. Yet, of an estimated 9 million species on earth, 2 million are marine, 91% of which have yet to be described.

As Françoise Gaill explains, the function of scientific knowledge is to raise awareness, among the general public and decision-makers, of the need to protect these environments and of how this constitutes an opportunity for humankind to make them its own.

Neither easily accessible, nor observable by satellite due to their turbidity, and dependent on very complex interactions, marine environments are still poorly understood.
© Ant Rozetsky on Unsplash

Françoise Gaill — The ocean, a global commons

There is only one ocean on the planet; it interconnects all seas and oceans to form a global ocean. The thermohaline circulation allows a drop of water to travel around the earth and return to the same place after a thousand years. This ocean/atmosphere connection drives climate science. Winds cause movement of the ocean surface that is transmitted to the entire volume of the ocean, driving the ocean circulation engine. The ocean helps regulate the climate system, capturing nearly 30% of the carbon dioxide in the atmosphere and storing more than 90% of the thermal energy from our anthropogenic activities.

The ocean creates 50% of the oxygen and more than 90% of the water we need to survive, not to mention that it is a fantastic capital of natural resources (energy, minerals, living and genetic). The diversity of energies that the ocean can provide is vast: energy from swell, tides, temperature differences and the potential of currents going towards the poles. With regards to the fishing industry, yields are in free fall, because of climate change and pollution, but also because of overfishing and illegal fishing. Researchers are questioning whether we are at «tipping points», which are often irreversible. The Newfoundland cod example shows that certain human actions have irreversible consequences like species disappearance and the replacement of its ecological niche, preventing its return.

There is growing recognition of the importance of the ocean in the functioning of the planet, climate and biodiversity, minerals, energy or living resources. The ocean space is becoming a salient current issue as one of the last natural spaces not governed by any state. Consequently, this aspect has led some of us to consider the ocean as a global commons. Such a term, used by the President of France at the Conference on the Economy of the Sea, means we need to be responsible for taking care of the ocean for tomorrow's societies. We are all involved.

Françoise Gaill is an oceanographer, director of research at the CNRS, and vice-president of the Ocean & Climate Platform.

With this aim in mind, Unesco's Intergovernmental Oceanographic Commission (IOC[26]), the United Nations body responsible for ocean science, launched in early February 2021 the *UN Decade of Ocean Science for Sustainable Development*[27]. This initiative aims to strengthen scientific capabilities and produce knowledge that will contribute to the sustainable development goals. It also seeks to strengthen ties between marine scientific research and the private sector, particularly over digital systems, with a view to improving ocean monitoring and making better use of the results of different oceanographic missions.

Ten ocean science challenges have been identified for the 2021-2030 decade:

1. Mapping of land and sea sources of pollutants or contaminants, and design of solutions to eliminate or prevent them.
2. Monitoring, protection and restoration of ecosystems subject to multiple stressors.
3. Optimisation of the ocean's role as a sustainable food source.
4. Equitable and sustainable development of the ocean economy.
5. Ocean-climate linkages, improved forecasts, mitigation and resilience solution design
6. Multirisk warning systems and population preparation.
7. Accessible and easy-to-use ocean observation system.
8. Full digital representation of the ocean with free and open access.
9. Capacity building, improved data and technology access.
10. Changes in behaviour and humankind's relationship to the ocean.

26 http://www.unesco.org/new/en/natural-sciences/ioc-oceans/
27 https://www.oceandecade.org/

Many of these challenges are common to, and shared by, businesses operating in marine environments.

The geo-engineering solutions (fertilisation, alkalinisation, etc.) set out in 5 above, while legitimate topics of research, should be approached very cautiously for the purposes of international initiatives[28] and the scientific community[29].

RTE's Research and Development program in the field of marine biodiversity: Science to support, preserve and regenerate

RTE's Research and Development (R&D) program in the field of marine biodiversity aims to acquire scientific knowledge to take into account biodiversity and related human activities in the life cycle of underwater electrical connections and offshore substations. This is a major challenge in the context of climate change and energy transition.

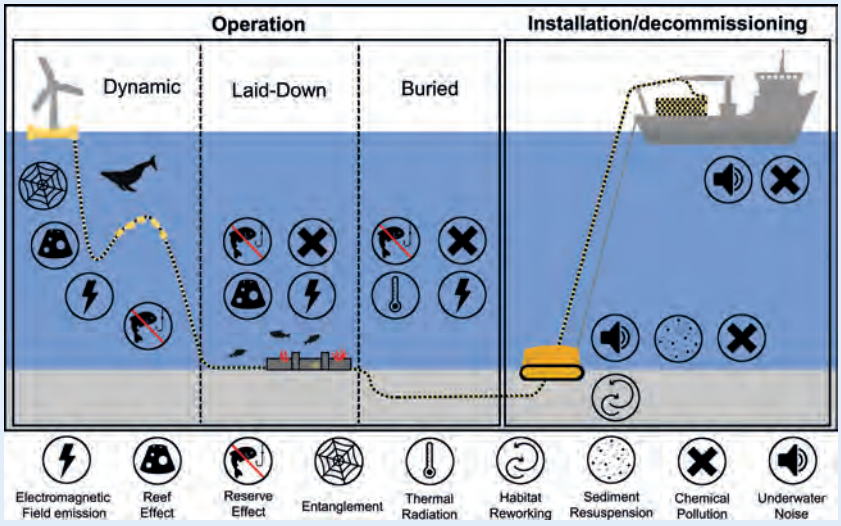
R&D projects are designed to address all stages of the life cycle of offshore power connection facilities: Study phase, construction phase, operation and maintenance phase and dismantling phase. By designing the connection systems to have the best possible environmental footprint, eco-design studies and enables the implementation of solutions at each stage of the life cycle.

Depending on the phase of the infrastructure's life cycle, the potential effects generated in the marine environment (see diagram[30]) have a more or less long duration; the longer phase being the operation one. Effects depend on the location of the submarine power cable: in the water column (dynamic power cable for floating wind turbines), on the seabed (laid and protected power cable) and in the seabed sediment (buried power cable).

In 2019, IFREMER published a knowledge summary of these effects, highlighting their impact and uncertainty degree.

The effects resulting from the restriction of uses (reserve effect) and artificial structures (reef effect) above the submarine power cable are likely to have potentially positive impacts but this needs to be verified.

At present, 10 R&D projects are being funded to study the potential effects of submarine power cables installation and operation and the characterization of the environment dynamics in which future floating or installed offshore wind farms will be located. These projects, set up with TBM environnement, France Energies Marines, Pôle Mer Méditerranée and the University of Caen Normandie, are often integrated into research consortiums.



©Bastien Taormina

Diagram of the potential impacts caused by different types of SPC immersion (Dynamic, Laid-Down and Buried) during their operation and installation/ decommissioning phases, with the courtesy of Taormina et al. 2018.

28 https://www.oceanpanel.org/climate
29 Gattuso & al. (2018), https://www.frontiersin.org/articles/10.3389/fmars.2018.00337/full
30 TAORMINA B. ET AL. (2018) A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. Renewable and Sustainable Energy Reviews.

B Business contribution to scientific knowledge

Businesses benefit from advances in scientific and technological knowledge. The United Nations Global Compact (UNGC) and IOC-UNESCO have published proposals[31] to promote the contribution of business to this knowledge across various stages of development, from data collection and processing to data sharing and use. Technology, too, can accelerate innovations in our management of marine environments by providing tools for the understanding, monitoring and control of marine activities.

1 - Data collection, processing and sharing

Collecting ocean data involves different techniques from those frequently used in the open air. They are often very costly due to the shifting nature of the ocean, its sheer size, and the turbidity of the water. Many remote collection technologies exist or are under development (satellite and radar imagery, moored and drifting buoys, marine and aerial drones, cameras and embedded equipment). Combining these diverse sources into integrated solutions is a subject in its own right.

Businesses collect information:

i) during pre-project study phases (e.g. an environmental impact study linked to an offshore energy project),

ii) with the help of scientific equipment aboard vessels (e.g. cameras or probes on board fishing or commercial vessels),

iii) while performing other activities (for example, Airbus provides some environmental NGOs with satellite images taken for other purposes).

Processing capabilities (big data, artificial intelligence) will play a vital role over the next decade as data sources and volumes multiply.

Sharing this growing volume of data is key to the equitable management of ocean resources, according to the *High Level Panel for a Sustainable Ocean Economy* [32]. The data is currently stored on servers belonging to governments, research centres and businesses. Access to this data involves overcoming technological, organizational, and even commercial obstacles arising from how it is processed.

Microsoft

Bringing ocean data to life

Imagine that the millions of environmental data collected around the world would come to life: the Arctic would reveal its precise seal population, automatic analysis of beluga whale song would detect their presence, and rainfall would be predicted within 15 minutes. Bring field data and satellite images to life to improve biodiversity protection is the goal of Microsoft's Planetary Computer. Every day more and more biological, physical and chemical data are created; however, the lack of harmonization makes it difficult to synthesize and generalize their analysis. This does not allow their exploitation on a global scale, while, for example, changes in forest area in Brazil can affect the climate in Europe. The Planetary Computer, therefore, responds to a challenge of pooling available information to better understand their interdependence. With this in mind, 10 petabytes of scientific data are stored on the Microsoft Cloud, Azure. Open to all, they are then analyzed by artificial intelligence programs that allow researchers or start-ups to better understand and protect biodiversity. The Planetary Computer makes available data on the Pacific seabed, collected by the Ocean Observatory Initiative through high-definition cameras. Therefore, even if the ecological challenges remain abysmal, the environmental data have found a safe harbor.

https://innovation.microsoft.com/en-us/planetary-computer

31 Advancing Science for Sustainable Ocean Business - https://www.unglobalcompact.org/library/5744
32 https://www.oceanpanel.org/blue-papers/technology-data-and-new-models-sustainably-managing-ocean-resources

Space technologies contributing to ocean observation and knowledge

Thanks to three types of instruments (optical, altimetry/radar and atmospheric sensing), space oceanography has revolutionized our ability to observe the oceans. It provides global, near-real-time access to observations of ocean variables that are essential for studying oceanic processes and climate change, such as topography, temperature, ocean colour, sea ice, sea state, salinity and ocean-atmosphere coupling.

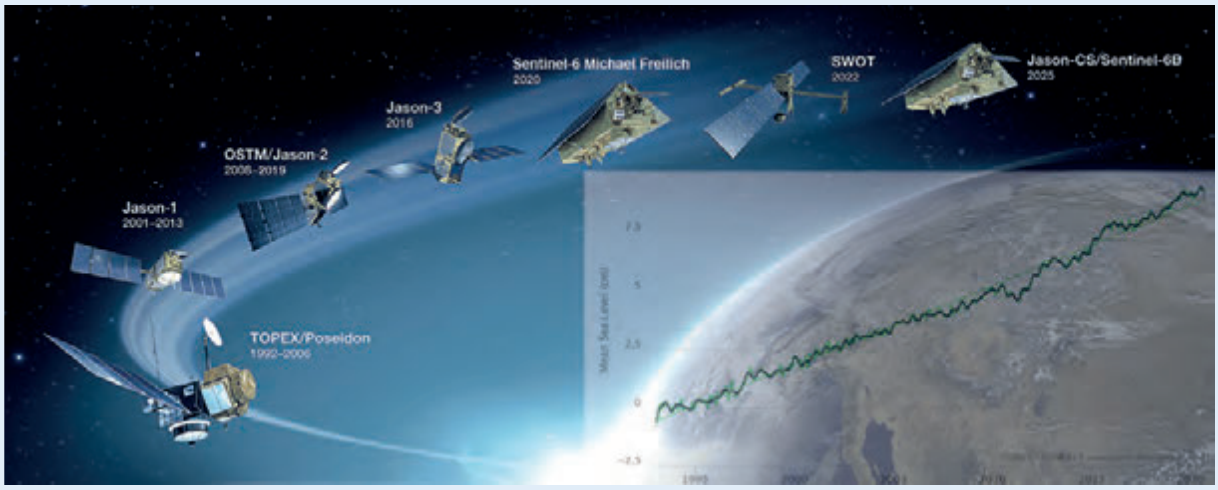
Sentinel-6 Michael Freilich[33] is the successor to the Topex/Poseidon and Jason-1, -2 and -3 missions, developed in partnership by CNES and NASA, along with NOAA and Eumetsat as of Jason-2. It was successfully launched on 21 November 2020, becoming the first *Sentinel-6* satellite of the Copernicus constellation[34]. CNES remains the major player in the ongoing performance of this Topex/Jason/Sentinel-6 series, dedicated to the continuity of altimetry and climate measurements for many years now.

Ocean and climate are intrinsically linked, and rising sea levels are proving to be a key indicator of global warming.

Every ten days, *Sentinel-6 Michael Freilich* will cover 95% of the ice-free oceans, measuring sea level with unprecedented accuracy (less than a centimetre over a year).

This level of accuracy will be invaluable for observing coastal areas with high population densities, as these are particularly vulnerable to the devastating effects of rising sea levels and extreme weather events.

Following the launch of *Sentinel-6A*, its twin, *Sentinel-6B*, is slated to join it and then take over in 2025 at the earliest to assure continuity in measuring the effects of global climate change.



Altimeter series and mean sea level rise in centimetres since 1992.
© Nasa, Cnes, Legos, CLS.

33 Sentinel-6 is also known as Jason CS, for Jason Continuity of Service.
34 Copernicus is a European Earth observation programme managed jointly by the EU and ESA.

Impact assessments, knowledge and anticipation tools

Total's commitment to respecting and protecting the environment is present at every stage of an exploration and production project. Through its technical guidelines and its commitment to preserving biodiversity and the climate, Total systematically conducts an environmental and social **baseline study** (ESBS) prior to each project, followed by an environmental and social **impact assessment** (ESIA) to identify, quantify, avoid, reduce and compensate the potential impacts of its activities on the surrounding environment.

The **baseline study**, carried out by independent companies and experts, allows for a true environmental and societal diagnosis of the reference state, as well as an analysis of alternatives **to avoid** potential impacts identified. In most cases, the initial assessment is made up of the following elements: bibliographic studies; cartographic summaries; characterization of biodiversity through observations and inventories of flora and fauna; ecosystem studies; sampling and analyses of both the physical environment and living matter (plankton, benthos, etc.); studies of local communities, their lifestyles and standards of living, etc. The data from the initial assessment are widely shared with scientists via the international GBIF platform. In French Guiana, for example, a team from the Muséum National d'Histoire Naturelle (National Museum of Natural History) worked on the oceanographic vessel to improve knowledge of the environments analyzed.

The **impact assessment** (Environmental and Societal Impact Assessment - ESIA), undertaken at the design stage of a project, makes it possible to assess the potential impacts of operations on the environment and communities and to implement measures and technical solutions to eliminate, reduce or compensate for these impacts. A specific monitoring plan ensures that the measures put in place are properly followed up.

2 - Using data

Unprecedented amounts of ocean information should allow policymakers, businesses and investors to make more informed decisions on the sustainable management of marine ecosystems.

Seabed mapping and geological data collection, living ecosystem observation, modelling, and stakeholder identification will open up a wide range of potential applications:

- **Coastal and offshore infrastructure feasibility and impact studies**. Understanding the potential impacts of building offshore wind farms requires prior knowledge of the behaviour of the species and ecosystems present.

- **Risk assessment (insurance and reinsurance)**. Coastal environments are particularly exposed to ocean-related ecological, biological, meteorological, climatic and anthropogenic hazards. Enhancing understanding of these phenomena and improving predictive capabilities would make it possible to anticipate and thus reduce the potential impact of these risks.

- **Innovation and biotechnology**. Identifying the characteristics of many still-unknown plant, animal and bacterial species will spur innovation, such as the use of algae to manufacture cosmetic thickeners and gelling agents, and the identification of biomolecules of pharmaceutical interest.

- **Optimisation of shipping navigation routes and development of autonomous ship systems**. One of the challenges faced by fleet managers is managing unexpected disruptions that can impact port-of-call planning, transhipments and ship speed. As these elements are highly complex and multifactor, they are particularly relevant for optimising data and improving processing capacity.

- **Marine ore exploration and exploitation**. Some seabeds are particularly rich in rare metal ores (e.g. cobalt, manganese) used by some new technologies (batteries, photovoltaic, wind). Seabed mapping and geological knowledge of soils and subsoils help to identify potential deposits.

- **Marine environmental monitoring**. Measuring and understanding physico-chemical parameters can enable corrective measures to be implemented (see Veolia box).

- **Sustainable management of marine resources**. Fishing vessels over 300 tonnes must be fitted with an automatic identification system (AIS). Improving capabilities to cross-check fishing vessel detection with the absence of AIS data, or to identify movements suggesting possible fishing activity, can help combat illegal practices

Exploiting the growing amount of data is therefore critical. For example, satellites and AIS collect data over long periods of time (AIS data is stored for seven years). Once the data is acquired, the marginal cost of using algorithms to identify pollution or study wildlife is usually low. Sharing satellite data and images thus avoids "single-use" data. Similarly, many technologies for monitoring or managing marine areas can emerge only with the creation of a diverse market or system of incentives. Indeed, some of the technologies available for monitoring fishing, shipping emissions, and various types of pollution do not yet yield returns on investment commensurate with investor expectations.

The issues of research funding and data processing encapsulate the ambiguities of sustainable development. To protect the environment, data is needed; however, to obtain and exploit this data the economic prospects have to be upbeat, which in all likelihood will increase the sort of pressures reported in chapter one.

That is why businesses that see the ocean as a source of development ought to focus from the outset on measuring and preventing their impacts.

AIRBUS

Essential assets for the satellite maritime surveillance

Airbus is the main European Aerospace company and listed as one of the top-10 defence companies in the world. For more than 50 years, Airbus has been supporting its customers' maritime missions thanks to its maritime surveillance systems, geospatial and intelligence data, multi-role aircraft and among the most advanced UAS.

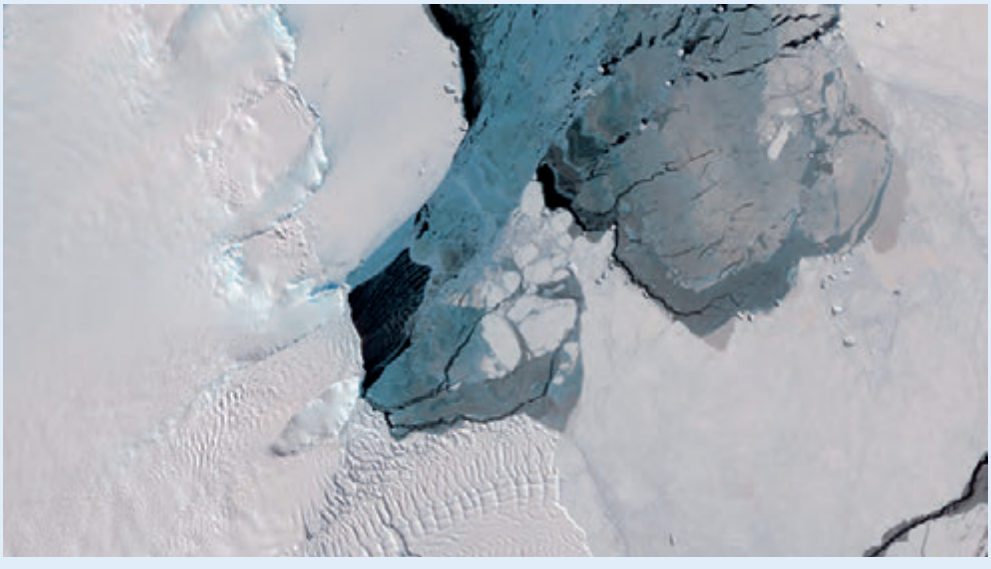
Mastering satellites (Pléiades, SPOT, DMC, TerraSAR-X, Tandem-X, etc.), data and the information source correlation (AIS and images, for instance) help detect hydrocarbon pollution. This analysis, contributing to culprit identification, is provided as a service offering the responsiveness vital to users.

Airbus is also involved in the reduction of greenhouse gas produced by international maritime transport while measuring the emitted gas via sensors installed aboard various space or air platforms.

A system like STYRIS®, a coastal surveillance system, while defining marine protected areas and monitoring ships coming in or out of these areas, is an undeniable asset for maritime surveillance and to combat illegal fishing. It enables ship detection, tracking, abnormal behaviour identification and real-time alarms.

Essential assets to model oceans and anticipate rising water level, the Sentinel-6 satellites will measure with unprecedented accuracy ocean surface level variations thus providing information about current direction and speed as well as ocean heat content.

Relying on maritime domain experts (former European Navies officers, scientists, subsidiaries ...) and nurturing innovative ideas, Airbus is committed to protecting the environment and striving for safer oceans.



Mertz Ninnis Valley, Antarctica, DMC satellite image ©UK-DMC2 2018 Airbus DS

Reducing coastal pollution at source: a solution for preserving sensitive uses

Freshwater, saltwater, same battle! Most coastal marine problems originate on land. To preserve the seas and oceans, it is essential to act at the source of pollution and to work at the level of coastal catchment areas, combining knowledge, governance and finance.

As an interface between water and land, the coastal band is a very attractive area for active, sedentary, tourist and seasonal populations. The management of conflicts of use is not limited to the allocation of natural areas but also concerns urbanised areas. Sensitive economic uses (bathing, shellfish farming) require high-quality coastal waters, which are not compatible with industrial discharges, or raw urban and rainwater discharges.

In this context, implementing the «monitor - anticipate - reduce» continuum is the key to helping to restore and preserve the quality of coastal waters on which sensitive uses such as seafood farming or coastal recreational activities depend. Water quality is the first limiting factor to be removed to ensure the sustainability of uses and to start acting to preserve and restore the coastal marine environment. The role of coastal sanitation and stormwater management is essential to act as a barrier at the land-sea interface.

Veolia is implementing active surveillance solutions. The Bay of Lazaret is a good example. A fragile site, it supports a maritime economy recognised for its shellfish farming, aquaculture, fishing, naval base, shipyard and maritime transport uses.

Together with the Toulon Provence Méditerranée Urban Community, Veolia has set up an operational system for monitoring the water quality of all the rainwater stations that surround the bay in order to preserve its uses. The system is based on a plan for regular measurements of water quality at the stations and sensitive points. A bad result triggers an alert to the community and the stakeholders and a search for the source of pollution. The system is mapped and supplemented by floats equipped with multi-parameter sensors that provide data in real-time, giving the «weather» of the state of the marine environment.

Monitoring, tracking, tracing, anticipating and reacting are the processes put in place by Veolia for continuous monitoring around the bay. Every drop of polluted freshwater that enters the bay is tracked down, and the source of the pollution is searched for and identified in the vast majority of cases. This makes it possible to reduce and control the impact of land-based pollution on the quality of the coastal environment to preserve the sensitive uses of the bay, primarily the ancestral activities of seafood farming.

Water quality monitoring floats in the Bay of Lazaret.
©VEOLIA

C Businesses monitoring their activities

1 - Measuring and reducing impacts on the ocean

There are several reasons why measuring businesses' impacts and dependence on the ocean requires special efforts:

- The potential impacts are highly varied (pollution and emissions, marine resource use) and can already be partially or totally measured by each business;
- Impacts can be direct as a result of activities related to marine environments (transport, offshore and coastal activities), or indirect (GHG and pollutant emissions, waste production). This means all activities could be concerned.

To help businesses measure their impact on marine ecosystems, the Fondation de la Mer and BCG have worked with industry, the French Ministry for Ecological Transition and other stakeholders (WWF, Tara Ocean Foundation, CNRS, Planète Mer) to create a reporting referential for SDG 14. This referential is structured around three main interactions between businesses and oceans organized into 32 types of impact. Lastly, for each of the 44 drivers identified, a reference indicator and a normative value are proposed.
Each business is free to change them, and is asked four questions for each impact:

1. Is the impact material to the business?
2. Is the indicator measured?
3. Is it consolidated at group level?
4. Is it included in group reporting?

Measuring mast at the entrance to Le Havre port as part of the Fécamp wind farm project.
©EOHF - Laurent Critot

FONDATION DE LA MER

BCG BOSTON CONSULTING GROUP

The Ocean Framework

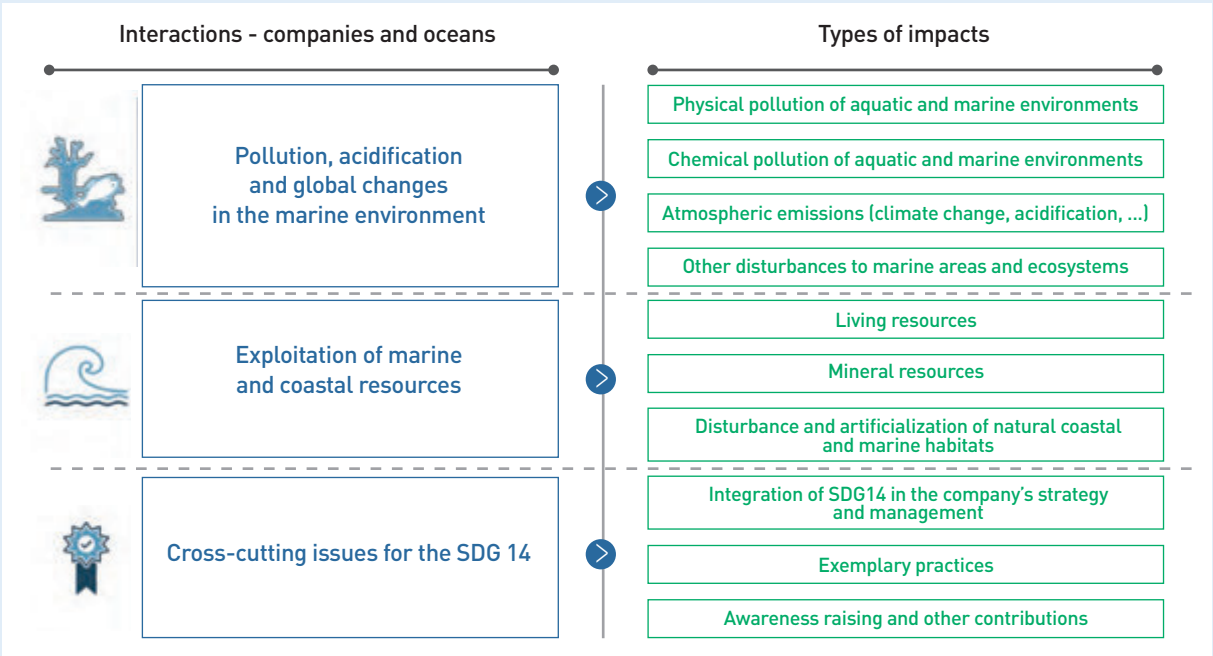
Each year, more and more companies are seizing the Sustainable Development Goals. Climate change and the preservation of biodiversity are among their top priorities. And yet, the Ocean, which is at the crossroads of these two issues, is very little present: only one company in seven mentions the SDG14 in its CSR strategy.

The Ocean Framework is in line with the Foundation's logic of action: facing the climate emergency and the deterioration of life in the Ocean, Fondation de la Mer supports all types of stakeholders to accelerate and amplify their actions in favour of a healthy Ocean. It also develops its own projects to protect marine biodiversity, combat pollution at sea, support research, encourage innovation, and inform and raise awareness among the public.

To assist companies in preserving and sustainably exploiting the Ocean resources, Fondation de la Mer developed the Ocean Framework. It was designed in collaboration with the Ministry of Ecological Transition and the Boston Consulting Group and associated a large panel of stakeholders and renowned experts. The Ocean Framework was built and successfully tested with companies (Suez, Michelin, Pierre et Vacances, Club Med, Naval Group, Louis Dreyfus, Engie, Nausicaa, Hopscotch).

A world premiere, available in free access, this tool enables companies of all sizes and sectors of activity to grasp the SDG 14 by evaluating all their interactions with the Ocean. The Ocean Framework adapts to every company, enabling them to set objectives and take concrete action, depending on their subjects and strategy.

To encourage companies' commitment, an «Ocean Approved» web platform is at their disposal (www.oceanapproved.org). It gives access to qualified information, the sharing of good practices, testimonials from user companies, and personalised support offer to handle the Framework. Fondation de la Mer has accompanied about ten companies so far.



An impact assessment can provide multiple benefits for businesses, including:

- identification of potential impacts of all activities, including those that may have been neglected (e.g. noise)
- contribution to business impact reduction plans
- onboarding of all teams: corporate reporting (indicator tracking), operational site management (water, waste, air emissions), procurement (plastic supplies at sites), etc.
- support for dialogue with stakeholders, for example with suppliers on marine transportation issues (ballast water, paint, etc.).
- update of reporting and performance indicators, globally and locally.

From an operational standpoint, the adoption of an impact assessment and management approach raises a number of issues:

- availability of data necessary for assessing indicators
- prioritisation and hierarchisation of indicators
- expertise required to define relevant thresholds for different indicators
- methods of integration into existing reporting systems (number of indicators, format, local or global reporting, etc.).

In addition to the direct impacts of their activities, some businesses assess the potential impacts of the products and services they make available to their customers. This second approach involves taking into account the production, use and end-of-life stages of the product life cycle. LCA (life cycle analysis) methodologies are particularly suited to this exercise because of their multi-stage and multi-criteria features. The results of these studies in turn serve to improve product performance at different stages of the life cycle (design, production, use and end of life). Because businesses forge a link with their customers through their products and services, these actions also offer an opportunity to communicate and share with consumers the practices put in place. That is why special attention is paid to methodological rigour and dialogue with stakeholders, who assess the relevance and quality of the approach.

The Dragonfly Zone (Zone Libellule) for «Biological Freedom and Tackling Emerging Pollutants» connected to a wastewater treatment plant - ZHART project (Wetlands) - SUEZ

Assessing and designing more sustainable products with Green Sciences

L'Oréal has undertaken a profound transformation of its Research & Innovation activities by orienting its methods towards Green Sciences (Biosciences). The Group has set for itself new goals: by 2030, 95% of its ingredients will come from renewable plant sources, abundant minerals or circular processes and none of its formulas will have a negative impact on aquatic ecosystems. The Group wants to offer its consumers safe, more efficient and more environment-friendly products.

L'Oréal will build on recent advances in Green Sciences, to cultivate ingredients sustainably and extract the best from nature using high technology processes. In 2020, already 80% of the Group's raw materials were readily biodegradable, 59% were renewable and 32% were natural or of natural origin. 29% of the ingredients used in L'Oréal's formulas have been developed according to the principles of Green Chemistry.

Furthermore, L'Oréal continues to improve the environmental profile of its formulas. In 1995, it set up a research laboratory to measure and model the impact of its products on water and soil and biodiversity. As part of its *L'Oréal for the Future* program, the Group has committed to assess, by 2030, 100% of its formulas using its environmental test platform, to guarantee they are respectful of all aquatic ecosystems, whether continental or coastal.

© L'Oréal

2 - Managing risk and financing the sustainable blue economy

In a global context marked by increasing uncertainties as well as complex and multiple potential impacts on nature, risk management by businesses is growing in importance every day. Since the launch of the Task Force on Climate-related Financial Disclosure in 2017, finance and business have made progress in assessing climate-change risks and factoring them into the management of their portfolios. Extending this approach to ocean-related risks could help limit business exposure. According to a study by Responsible Investor for Credit Suisse in 2020, three in four investors surveyed did not assess the impact of their portfolios on the ocean, and 21% are completely unaware of their exposure to ocean-related risks from an investment standpoint.

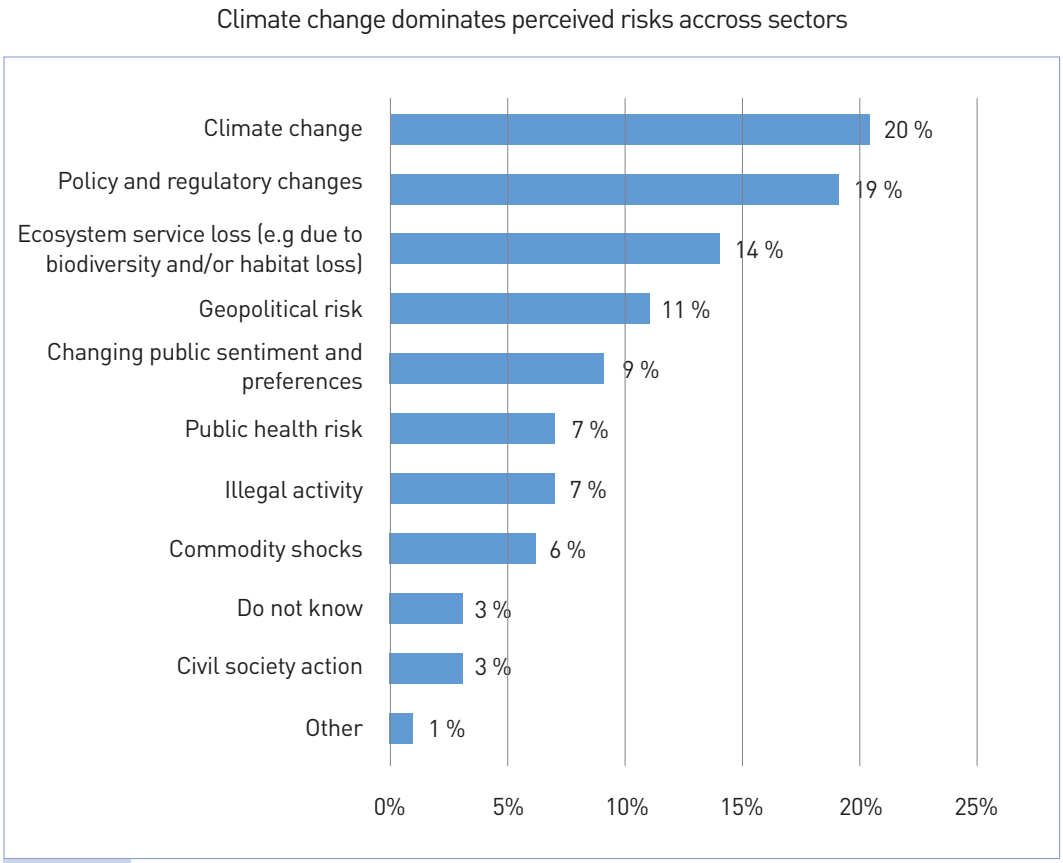


Figure 4

Main non-financial risks according to maritime economic players. Source: UNEP FI, Rising tide report, 2021

The UNEP FI study from which the above table is excerpted reveals that climate risks and risks associated with the loss of ecosystem services are perceived as one of the three biggest risks (see Figure 4). Risks to marine activities, finance and investment are mainly twofold:

1. Physical risks such as direct damage caused by events related to the weather (tornadoes, storms), climate (rising water, flooding), or environment (pollution, resource depletion in quantity or quality). Such events could put fishing activities at risk in the face of high vessel fixed costs and declining fish stocks and, consequently, revenues.

2. Transition risks, arising from changing economic models, regulation (ship emission standards, fossil resource taxation), technology, financing (activist divestment, investor dialogue as in the case of overfishing) and markets (consumer demand for greater traceability). These can lead to asset depreciation.

As the measurement and management of such risks is important for businesses - including those in the financial sector - the exercise is sometimes performed collectively. Assessing flooding risk is the subject of one of the Ocean Risk Alliance projects. For banks, customer risk management may entail an assessment of ESG (environmental, social and governance) standards and the adoption of sectoral or cross-cutting policies.

The Poseidon Principles (see Société Générale box) applied to the shipping sector are a collective initiative whereby banks undertake to annually report on the carbon intensity of their shipping portfolios and assess whether their lending portfolios are in line with decarbonisation pathways.

On the other hand, the increasing exposure of some sectors to those risks offers numerous investment opportunities arising from the transition of large sectors of activity. In the traditional sectors of the maritime economy, the major challenge for financial players is redirecting their capital from environmentally and socially damaging activities to-sustainable and transitional activities, while supporting the transformation of economic stakeholders. Renewable marine energy, decarbonisation of shipping, and adaptation of coasts to rising waters should be attractive to investors, although the OECD concluded in 2019 that of the 17 SDGs the ocean (SDG 14) accounts for the lowest share of investment (3.5%)[35].

To enable banks, insurers and public or private investors to fulfil their key role in building a sustainable blue economy, the European Commission, WWF, the World Resources Institute (WRI) and the European Investment Bank (EIB) published in 2018 fourteen *Sustainable Blue Economy Finance Principles*[36]. This framework has since been adopted by the United Nations Environment Programme's Financial Initiative (UNEP-FI) as part of the Sustainable Blue Economy Finance Initiative, which brings together some 50 private stakeholders and NGOs. UNEP-FI regularly produces analyses such as the *Rising Tide*[37] report in February 2021, in which it maps the financial frameworks and tools used by the blue economy's most committed players.

Private financial players can subsequently put in place tailored financing solutions with a positive impact. Since the bond market is the largest asset class in the global financial market, blue bonds are seen as a high-potential financial product[38] spurred by growing investor demand.

These wide-ranging approaches, of course, require financial players to have extensive data access and processing capabilities, together with a good understanding of the causal links between the various phenomena affecting the ocean.

35 http://sdg.iisd.org/news/oecd-launches-tool-to-analyze-sdg-finance/
36 https://www.unepfi.org/blue-finance/the-principles/
37 https://www.unepfi.org/publications/rising-tide/
38 UNGC Blue Bond Reference Paper: https://unglobalcompact.org/library/5741

Ocean Risk Initiative: driving innovative solutions in a changing world

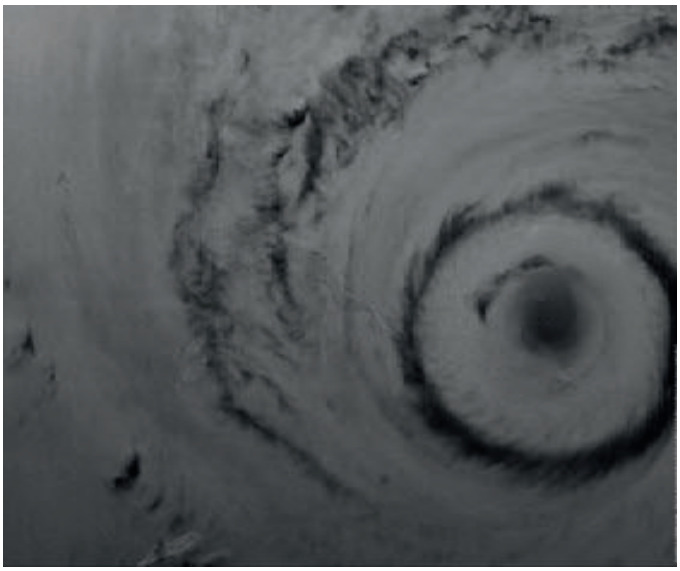
In the last ten years, the insurance sector has paid out over US$300 billion for coastal storm damage, and by 2050, rising sea levels and extreme weather is expected to cost coastal communities around the world up to US$1 trillion annually.

Recognising these impacts, AXA XL founded the Ocean Risk Initiative in 2017 to create new finance and insurance solutions to help our clients, communities and countries, manage and mitigate ocean-related risk and achieve greater resilience in the face of climate change.

Driving Product Innovation.
The Initiative works to develop new products that incorporate nature-based solutions to close the protection gap, while restoring and protecting biodiversity and building resilience for the most vulnerable. AXA XL is working with its partners to build the framework for an insurance product for mangroves and is leading the development of a Coastal Risk Index which will integrate the protective benefits of coastal ecosystems, like coral reefs and mangroves, into insurance flood risk models for the first time.

Leading the Insurance Industry Response to Ocean Risk.
Building on the commitment to use the industry's expertise in risk management and investment, AXA co-founded the Ocean Risk and Resilience Action Alliance (ORRAA) in 2019 with the support of all G7 countries. ORRAA, is a multi-sector collaboration between governments, financial institutions, the insurance industry, environmental organisations and stakeholders from the Global South to pioneer finance and insurance products that incentivise investment into building resilience through nature-based solutions.

Increasing Ocean Literacy.
As the foundation of the Ocean Risk Initiative, we aim to increase ocean literacy at all ages and in all sectors to develop a generation of ocean-minded leaders that are able to incorporate sustainability into their decision-making. The AXA Ocean Education programme provides teaching resources and live lessons to drive ocean literacy into the classroom – so far reaching over 8.5 million children around the world. We are now working with UNESCO to support the UN Decade of Ocean Science, including developing an ocean literacy toolkit for governments that can help integrate ocean learning into formal education curricula around the world.



Satellite image of the eye of Hurricane Irma.
© DLR e.V.2017 and © Airbus Defence and Space GmbH 2017

Transforming sectors and acting with territories

Since 2013, Crédit Agricole has established a sectoral «maritime transport» policy that guides financing and investment decisions (construction, repair and dismantling of ships, etc.).

In 2020, the group strengthened its commitments by:

(i) lowering the maximum age of funded vessels (or fleets) from 20 to 15 years old,

(ii) prohibiting leasing of open-minded vessels, and

(iii) directing its financing towards vessels using low suffer fuel. In 2020, Crédit Agricole CIB signed the Poseidon Principles with 10 other major maritime finance banks and joined 10 other major companies in the «Coalition pour l'énergie de demain» which is developing 9 projects to help meet the challenges of sustainable mobility in the transport industry, notably maritime.

In 2014, regional banks established a «marine sector» team to support the growth of activities related to fisheries, renewable maritime energy, aquaculture and biotechnology.

The dedicated team runs and develops a network of experts (French Maritime Cluster, Ifremer, competitiveness centers, etc.) and numerous stakeholders in the economic world of the sea ((fishermen, sailors, marine renewable energy, etc.) to enable the development of a cooperative model and co-creation of products and services. The goal is to foster innovation and to create a link between the research and business worlds through partnerships with the players in the local blue economy.

In particular, the marine sector team is present at the governance council of «Mer Concept or the Explore fund», is a partner of «the pôle mer Bretagne Atlantique» (Brittany Atlantic division) and supports players such as the «Mer Concept» ou «le fonds Explore», who aim to contribute to the de-carbonization of maritime transport. This unique cooperation between regional banks and local players allows the development of specific internal skills and supports the regional teams in structuring and accelerating the development of rapidly changing sectors.

Photo Marine Nationale

3 Developing new solutions to promote sustainable use of the ocean

Valuing the potential of the seas and oceans for human development requires new approaches that are more responsible and concerned about the impacts and externalities of business activities. In this third chapter, we will see that EpE member companies are working on new solutions to reduce the impacts of their activities on marine environments, improve their environmental performance, and meet the adaptation needs of coastal communities.

A Reducing environmental impacts

1 - Cutting emissions from marine activities

Businesses can contribute to climate change mitigation through a variety of solutions which are increasingly recognised as essential for achieving the Paris Agreement goals.

Decarbonisation of the various components of shipping (including motorised fishing vessels) is a major opportunity for marine and land-based economies to collaborate. Renewal of ship fleets (container ships, ferries, fishing vessels, etc.) and transition to new propulsion systems (LNG, hydrogen, ammonia, etc.) are essential, complementary and challenging in more ways than one. These developments will have a huge knock-on effect on the upstream stages of value chains, production, transport and storage infrastructure, and port facilities, among others. Energy-efficient technologies based on design, guidance and route optimisation will also contribute to decarbonisation.

Unquestionably, decarbonisation will have positive spinoffs, such as the use of Arctic shipping routes by oil-free ships that would reduce hazards for ecosystems.

The high cost of alternative decarbonised technologies should also help contain traffic growth in the quest for more efficient production systems.

Harnessing space technologies for shipping and marine areas management

With telecommunications, geolocation and satellite observation, CNES supports maritime stakeholders – particularly in the transport, fisheries, aquaculture, energy and coastal sectors – via three priority areas: smart routing, interactions between human activities and biodiversity, and port management.

Smart routing optimizes the management of the energy consumed by the ship, thus limiting its GHG emissions. The recent 2020 Vendée Globe sailing race has also shown that regardless of the progress made on boat design, managing the physical parameters (currents, winds, waves) is key to performance. Satellites, therefore, have the ability to measure these determinants for an energy-efficient and non-emitting navigation to enable smart ships to surf the waves, take advantage of the fair winds and follow the best current or, in the case of hybrid propulsion, choose the best on-board energy source according to the state of the sea.

Fuelled with up-to-date seabed and coastlines topography, good communications and efficient positioning, this smart routing will eventually allow entire fleets of autonomous ships to operate in the near future. Because they will be fitted with numerous measuring devices and sensors, aiming at collecting large amounts of data needed for their navigation, these ships could also help increase the available knowledge and ensure the surveillance of maritime zones such as marine protected areas. Working alongside satellites, they could also help undertake underwater measurements or favour offshore operations (cables, platforms, etc.).

The compilation and processing of data acquired via satellites, buoys or satellite-connected surface drones make it possible to monitor changes in water quality, pollution levels and even the drifting of plastic debris. In particular, these data can be used to anticipate and monitor the impacts on biodiversity, on the development of coastal and marine infrastructures and economical activities such as tourism or aquaculture.

A more specific example, ports concentrate these needs for automated and controlled management of maritime traffic, integration of infrastructures into the environment, prediction and reduction of pollution. Space technologies also enable them to generate more agile economic exchanges (remote auctions, management of renewable marine energies, logistics, etc.).

By contributing to the development of these tools with its partners, CNES is proving the importance of space technologies in order to support and enhance a sustainable blue economy.

Large tanker being refitted, Gdansk shipyard, Poland
©Shutterstock

2 - Reducing pollution and developing the circular economy

More than 10 million tonnes of "macrowaste" are released into the marine environment annually[39]. Of this, only 20% comes from maritime activities (transport, fisheries, aquaculture); the bulk (80%) comes from land-based activities. The benefits of the circular economy have been well established for a decade. In 2019, the Ellen MacArthur Foundation estimated that eliminating plastic packaging would create economic opportunities worth $10 billion[40].

Preventing

Plastic production has climbed two-hundredfold since 1950 to 400 million tonnes in 2019[41]. While the shelf-life of plastics used in construction spans several decades, more than 40% of the quantities produced - mainly packaging - are discarded within one month. Stabilising and then reducing production will, of course, require significant investment. The problem is what to do with the waste until then.

Treating

Solid and liquid waste collection and treatment facilities are an essential component of pollution reduction at source. They also open up new value creation opportunities from the resale of treated products. The French cleantech firm Ecoslops, for example, has developed a process to convert hydrocarbon residues from ship operations into new fuels.

Cleaning up

Whether through regular discharges or accidental spills, aquatic environments are regularly subject to pollution. Séché Environnement has developed a specific operation that allows action to be taken at sea to limit the effects of pollution (see box).

Deconditioner for bales containing collected plastic bottles - SUEZ Plant – France Plastic Recycling – © SUEZ / MH productions / Philippe Mencia.

39 https://ree.developpement-durable.gouv.fr/themes/milieux-et-territoires-a-enjeux/mer-et-littoral/
40 https://www.ellenmacarthurfoundation.org/publications/reuse
41 Plastic Atlas 2020, Heinrich Böll Foundation.

A humane and technical expert to fight marine pollution

One of the most urgent and worrying environmental crises is ocean pollution. As a result of human activities, an average of 6 million tonnes of hydrocarbons is spilled into our oceans every year.
Remediation actions are generally complex and require specific knowledge to effectively treat a wide variety of hydrocarbons.

Fast intervention into various environment types (marine, submarine, coastal) requires very specific resources. To address this problem, Séché Environnement, a leader in waste treatment and recycling, created Séché Urgences Interventions (SUI) in 2014. This subsidiary is a true internal task force able to mobilize up to 180 people on major urgent operations, 24/7. With its technical expertise, SUI is able to respond to all environmental emergencies, whether accidental or residual, as well as decontamination.

For example, SUI intervened in La Rochelle's port following the sinking of the ship Grande America in 2019. SUI was in charge of managing hydrocarbons collected at sea by anti-pollution ships. SUI works in port zones with international industrial companies and manufacturers on different hydrocarbon products spill.

To address effectively accidental marine pollution, competent public authorities can rely on the human and technical resources of Séché Environnement, listed in the POLMAR (marine pollutions control plans, launched by local prefects), on all the framework agreements currently in place on the French coastline.

© Séché Environnement

B Innovating and investing in new solutions

The opportunity also exists to make sustainable activities profitable. This can be a quite complex undertaking because many of the activities may be considered too small, too risky, or not yet showing a sufficient return on investment to justify massive capital injections. To support the development of solutions, various public, public-private and private mechanisms are available for different situations.

The large-scale development of **marine renewable energy** and electricity grids at sea is not only an important source of job creation and economic value, but also a key component of our efforts to decarbonise the national electricity mix. Wind energy is undergoing rapid development in shallow, and increasingly, in deep seas. Floating wind farms are coming across as a viable solution where shallow areas are already occupied by other activities, or the installation of wind turbines is not welcomed by local residents. Hydrogen production at sea to store and use surplus electricity production is one of the solutions being explored by some energy providers.

Capturing greenhouse gases with the help of natural and technological solutions also offers a number of opportunities. The sequestration potential of mangroves is estimated as being 3-5 times greater per hectare than that of tropical forests[42]; mangrove development also brings significant co-benefits, such as very rich biodiversity and coastal protection from marine erosion and storms. The conservation and restoration of underwater kelp and other macro-algae forests is another solution eliciting growing interest. It is estimated that more than 500 million tonnes of CO_2 could be captured annually by them and subsequently stored sustainably via sedimentation at great depths[43]. In France, mangrove restoration and protection projects can now be certified with the low-carbon label, and a methodology for the certification of processes for conserving and preserving Posidonia seagrass meadows is under development. There are technological solutions as well. Several projects run by Equinor, Shell and Total are working on CO_2 storage in former hydrocarbon fields.

Public authorities play an important role in driving public-interest projects, supporting innovation, and finding new economic models, while de-risking investment and so facilitating private capital deployment.

For example, in October 2018 the European Investment Bank launched the *Clean Ocean Initiative* aimed at providing more than €2 billion in funding for waste water and waste treatment projects between 2018 and 2023. Recently, it also invested in the *Sustainable Ocean Fund*, an investment fund designed to finance innovative projects and businesses in marine and coastal environments.

«It is estimated that more than 500 million tonnes of CO2 could be captured annually, and subsequently stored through sedimentation in the deep sea».
©Shutterstock

42 https://www.nature.com/articles/ngeo1123
43 Substantial role of macroalgae in marine carbon sequestration, Nature, 2016 https://www.nature.com/articles/ngeo2790

A dedicated investment fund and products to finance ocean-friendly projects

An unhealthy ocean puts all life on earth at risk: decades of mismanagement have led to the overexploitation and degradation of ocean resources. In response to this, Natixis is committed to developing financial products that have a positive impact on oceans, both in terms of investment and financing.

The Althelia Sustainable Ocean Fund (SOF), managed by Mirova, an affiliate of Natixis Investment Managers, invests exclusively in companies that sustainably harness the ocean's natural capital, build resilience in coastal ecosystems and deliver sustainable economic growth. SOF was launched in 2018, with Mirova finalising the fund's placement in 2020 at $132m. The fund has already committed to financing seven projects, including, in 2020, support for the development of Nextprotein (aquaculture) and Recycling Technologies (plastic recycling). The fund's impact objectives include protecting more than 17,500 hectares of mangroves and producing 177,000 tonnes of fish protein (whose carbon footprint is much smaller than that of meat proteins) sustainably.

Ocean preservation is also at the heart of all ocean project financing: systematic impact analysis and mitigation plans are carried out to preserve marine life and coastal populations.

Structured products are also integrating this issue, with the development in 2019 of the Euronext Water & Ocean Europe 40 index, composed of 40 European companies selected for their contribution to the preservation of water resources and oceans (equipment and services contributing to the resolution of water-related problems, mitigation of pressures on water resources, water pollution risk management). Combined with a green bond, this index has been integrated into Groupe BPCE's first 100% sustainable investment campaign in 2020.

Public-private partnerships are powerful solutions to leverage the potential of government action. Given the goal of protecting 30% of the world's seas, the upstream investment costs of establishing marine protected areas (MPAs), or even restoring natural ones, are likely to be significant. Private finance could participate in the initial investment, which has profit-making potential based on the revenues generated by sustainable tourism activities. For example, in 2018 the *Blue Finance Fund* concluded an agreement with the Dominican Republic to manage an 8,000 km² MPA through a public-private partnership involving government, business and NGOs. The fund raised $3 million in investment from a group of investors, including Mirova Natural Capital, a subsidiary of Natixis.

In France, there are two state-approved marine competitive clusters: *Mediterranean* and *Brittany-Atlantic*. Cornerstones of innovation policy, in particular for the benefit of SMEs, they bring together businesses, research and training organisations and local authorities within a specific territory. Using a collaborative approach, they approve innovative projects, and facilitate access to funding from local authorities, government and the European Union in six strategic fields:

- maritime defence, security and safety;
- shipyards and pleasure craft;
- marine energy and mining resources;
- marine living resources;
- environment and coastal development;
- ports, logistics and shipping.

LafargeHolcim SEABOOST

develops solutions for marine biodiversity restoration

LafargeHolcim is committed to taking an active role in the restoration and protection of marine ecosystems, and more specifically to prevent the loss of marine biodiversity. Alongside its strong commitments to lower its carbon dioxide emissions and achieve carbon neutrality, biodiversity has been a key pillar of its sustainable development strategy for several years. To meet the growing challenges of essential marine habitats, LafargeHolcim has established partnerships with start-ups to develop innovative solutions for the restoration of marine biodiversity.

As an example, LafargeHolcim and Seaboost (Egis Group) have combined their expertise to create artificial reefs. These reefs were submerged in the Mediterranean Sea, in the Calanques Regional Park, near Marseilles, France. The innovation has focused both on the biomimetic design of the concrete reef and on the formula and manufacturing process of the concrete used. This bioactive concrete patented by LafargeHolcim responds to specific stakes of porosity, pH and roughness allowing rapid colonization by a great diversity of marine flora.

After three years of immersion, the results on the development of marine flora and fauna are very encouraging: 62 species including 48 fishes have found a habitat in the artificial reefs, 80% of the species feed on the site. We have observed 12 species in the juvenile stage and rich breeding behaviour on site (with 35% of the species laying their eggs on the substrate). Bilayer bioactive concretes have shown an important performance of colonization with algae, five times greater than conventional concrete.
Apart from this project, LafargeHolcim and its partner have submerged several artificial reefs in various climatic environments such as the Atlantic, the Pacific or the Caribbean Sea.

The encouraging results of these pilot projects constitute a solid basis for the ecological functions of maritime structures and give more confidence to integrate ecology aspects in the early stage of the design. LafargeHolcim wishes to contribute to the generalization of these ecodesign methods for the construction of dikes, coastal or river solutions and more generally for the marine infrastructures of tomorrow.

© Julien Dalle, seaboost

Private players invest in start-ups that develop disruptive technologies or new models and are expected to be profitable in the medium term. Investors further support start-ups through networking, strategic back-up and, at times, contribution of skills and R&D. Accordingly, more than a third of investors surveyed by *Responsible Investors* in a study for Credit Suisse saw the sustainable blue economy – including adaptation, renewable marine energy and plastic pollution prevention (see Figure 5) – as one of the most attractive sectors over the next decade, and underlined the need for greater expertise and more sophisticated financial solutions to support its development. A case in point is Airbus's support and investment in Airseas, a start-up which has developed a dynamic sail that could achieve fuel savings of 20-45% for cargo vessels. Deployed on vessels up to 200,000 tonnes, the system is autonomous and adapts to changing weather conditions. Other French businesses, such as TWOT, are developing solutions that will make it possible to run lighter cargo vessels on sail power alone.

In addition to direct investment, partnerships with incubators and accelerators contribute to the emergence of new solutions. ZEBOX is a good example. Formed by CMA CGM and with the support of BNP Paribas among other institutions, it is dedicated to transport, logistics and mobility.

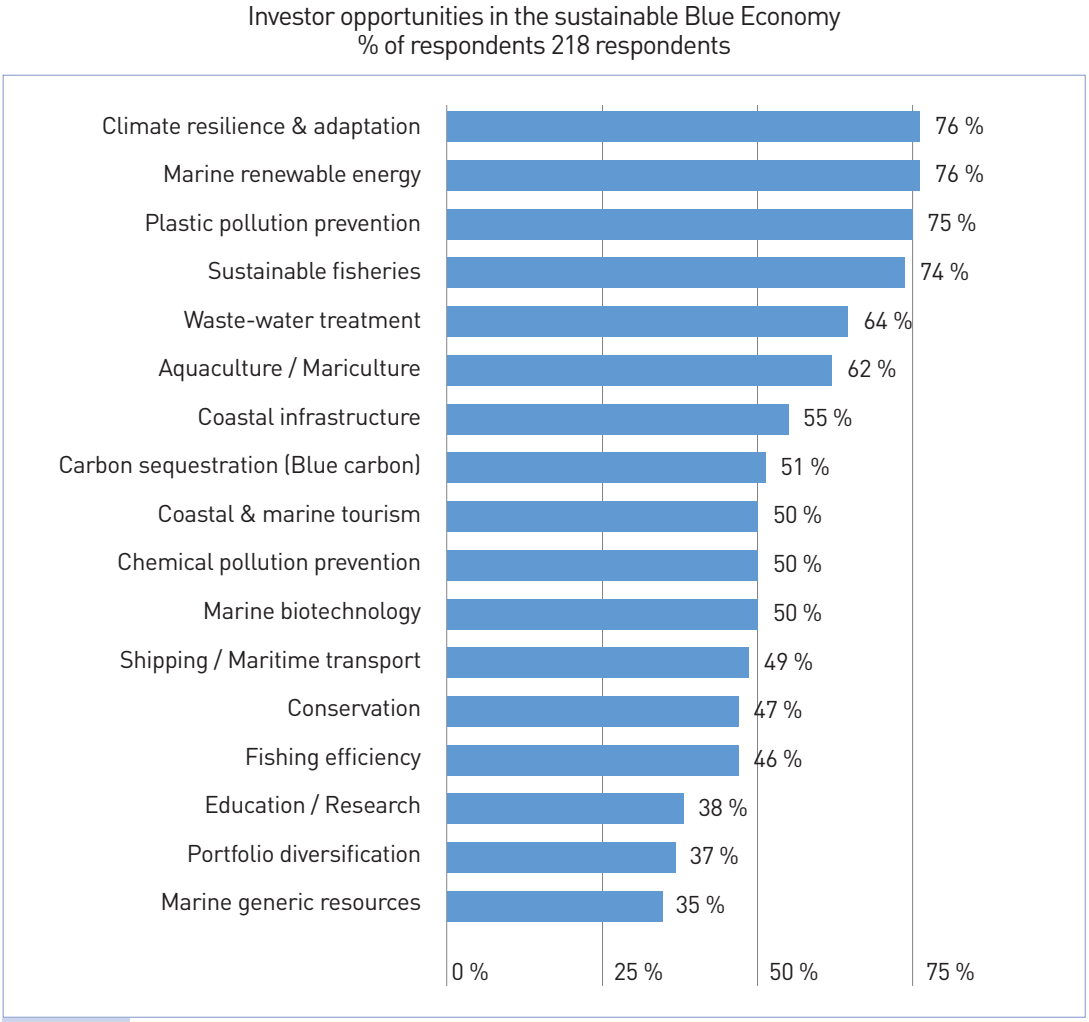


Figure 5

Opportunities in the sustainable blue economy as seen by investors. Source: Investors and the Blue Economy, 2020

Working with its stakeholders for better ocean protection

As part of its actions to combat climate change and protect biodiversity, BNP Paribas formalized in 2019 its engagement towards ocean protection through a dedicated public position. It includes a commitment to finance in the most responsible way sectors that are likely contributors to ocean ecosystems' disruption, like maritime transportation, fishing, or offshore infrastructures. In this regard, BNP Paribas combines its ESG (Environmental, Social and Governance) standards analysis on the shipping industry with an active client dialogue about their transition strategy. BNP Paribas accompanies their fleet modernization through CAPEX financing with for instance a 1bn Euros envelope by 2025 as well as dedicated banking products such as green bonds and loans

BNP Paribas' commitment seeks to move the needle in cooperation with all stakeholders involved in ocean protection. Working along with economic and civil society actors, BNP Paribas participated notably to the creation in 2020 of the Green Marine Europe label, a voluntary environmental certification program launched in France for the maritime industry with the Surfrider Foundation. Furthermore, BNP Paribas joined the Poseidon Principles banking initiative, and publishes annually the climate alignment score of its shipping credit portfolio. BNP Paribas also participates to the Global Fund for Coral Reefs initiative launched in 2020, the first UN blended finance fund organized through a coalition and dedicated to SDG 14 for the protection of coral reefs.

To go further:
https://group.bnpparibas/en/news/bnp-paribas-commits-responsible-financing-business-positive-impact-oceans

C Addressing coastal issues

Over the past few decades, coastal areas have undergone profound changes, mainly due to population growth and increased urbanisation, but also due to the effects of climate change and ecosystem degradation. Located at the land-sea interface, the coastline is subjected, as a result, to many pressures which are likely to get stronger as new uses are developed. The growing variety and intensity of uses will require the development of customised solutions.

The coast's capacity for resilience has deteriorated due to human activities (land-take, declining sediment supply, hydrogeological alterations, pollution). As a result, its exposure to oceanic hazards has increased. Rising waters, wave and wind strength, extreme weather events, sea heat waves, and melting coastal ice will increase in frequency and magnitude as a result of climate change. The ability of coastal cities to implement ecosystem protection, risk reduction, adaptation and restoration strategies is already being tested[44]. New York, for example, has invested $340 million in a coastal flooding adaptation programme that involves raising electrical installations out of the lower floors, converting those floors into non-critical spaces (gym, for example) and building "sponge" parks to mitigate the effects of flooding. In the Netherlands, buildings are erected to float on water so that they rise and fall with the tides. The *Living with water*[45] project involves 1,000 homes. A similar project for 3,000 people is due to be launched in Denmark. To take these aspects into account and offer new services, the Vinci Group has set up a dedicated unit (see box).

44 https://www.oceanpanel.org/blue-papers/coastal-development-resilience-restoration-and-infrastructure-requirements
45 http://nlintheusa.com/living-with-water/

RESALLIENCE by sixense

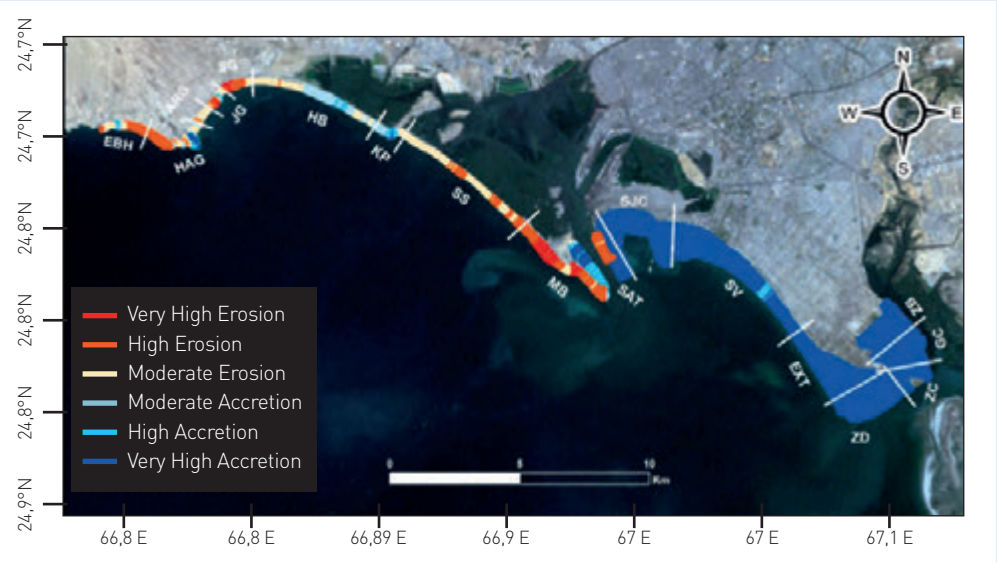
Solutions for adapting coastal territories to climate change

Resallience is a consultancy company of the Vinci group dedicated to the adaptation of projects, cities, territories, infrastructures, and their uses to climate change. Combined with technological solutions, monitoring, and innovative stakeholders' involvement, engineering solutions developed by Resallience allow modeling complex systems and climate perspective.

On the «ocean» subject, Resallience processes and analyses sets of spatial data over decades on the evolution of shorelines, associated with the scientific literature on climate change, allows calibrating robust and highly accurate predictive models. The objective is to anticipate the impacts of some coastal variations over the lifecycle of infrastructures. Even if it seems obvious that artificialization of shores and rigid structures modify the coastal process, decrease the sediment supply, and increase beach erosion, more and more amenities and (protection) coastal infrastructures are built without assessing their resilience capacity.

It is to face these challenges that Resallience is working with the IFC – World Bank on climate stress tests applied to critical infrastructures of island states and with Vinci and CDC Habitat on the impact of climate change on their Public-Private assets and investments.

Resallience is also working with the UNPD (United Nations Program for Development) on planning strategies of coastal zones in Western Africa. Resallience teams, in partnership with IRD, Rouen University, and the UNPD, models physical, financial and human impacts of climate change on the city of Saint-Louis, Senegal. However, lack of materials and information harm the adaptation capacity of this vulnerable territory. By mobilizing associations and communities, this pilot project allows planning investments dedicated to climate change adaptation through a 4D Geographic Information System applied to Saint-Louis, Senegal.



Evaluation of coastal vulnerability by Landsat and Cubesats in a coastal megacity (Majid Nazeer and al., January 2020)

The development of new infrastructure is also expected to address growing needs. Today, 40% of the world's population lives within 100 km of the coast and 11% in low-lying areas less than 10 m above sea level. The unabated growth of these populations is increasing the need for infrastructure (housing, transport, water supply, energy and telecommunications networks) and services (access to water, energy, food, waste disposal or reuse), and putting more and more pressure on available resources, such as water.

Marseille, the sewage system in the service of coastline protection

Aix Marseille-Provence city entrusted SUEZ with its ambition of seaboard protection: avoiding all pollution types released in the sea, contributing to the restoration of marine biodiversity, citizen awareness... Since 2015, the Group implements, with the local authorities, solutions which are operational and effective measures to reduce the city's impacts on the Mediterranean.

In the first place, wastewater and rainwater collections are maximized through a network management center: the PH@RE. It divides the hydraulic load on the drainage basin by interconnecting equipment. In case of important rainy weather episodes, rainwaters forward before being treat towards Ganay's retention basin, which is designed to avoid overflows in the Calanques natural park. Wastewaters are treated at the Géolide water treatment plant, the biggest buried plant in the world (78 million m^3 of treated wastewater per year) before being released into the sea. Coastline water quality is continuously monitored and during summer quality of swimming areas is analyzed. Those data can be shared with the citizens through the app Marseille Infos Plage. Through this solution, it is possible to know in real-time the water quality of the 21 city beaches.

To regenerate the natural habitat of fishes, SUEZ has implemented artificial nurseries in the port of «la Pointe Rouge». In the port waters, it is possible to count 3 to 8 more fish juveniles than before their implementation. Also, the Group manages urban cleansing in the 1st and the 2nd districts of Marseille. This service guarantees the constant cleanliness of the city and thus prevents the discharge into the sea of a large part of the waste thrown on the public highway. Finally, at Pennes-Mirabeau, SUEZ operates a waste treatment center at the Jas de Rhôde Ecopole. This site manages 94,000 tonnes of recyclable household waste per year.

Strengthen its commitment, the Group has carried a public/private Open Innovation approach, allowing to co-construct integrated solutions to fight the bay waste pollution, especially with the 2024 Olympic Games in sight. The Mare Nostrum project offers multi-partnership initiatives in collaboration with start-ups and local industries to protect the sea from waste pollution.

Artificial nursery for juvenile fish.
© SUEZ

The above examples show that, in the face of economic, social, and environmental challenges, businesses have a vested interest in – and are setting about - bringing to bear their ability to innovate, deploy and fund new solutions on improving co-existence between human communities and dynamic ecosystems.

Action, however, is hampered by the scope and complexity of solutions and situations, as well as by the interdependence of maritime stakeholders. Just as the atmosphere calls for risk sharing between stakeholders, and climate control requires collective action by all players, so the ocean as a unique and common asset demands collective action to control the risks its degradation poses for all.

Consisting of three archipelagos, the Republic of Kiribati located in the Pacific Ocean is one of the largest marine protected areas in the world.
© Airbus DS 2015

4 Enabling coexistence of uses and collective action

This chapter explains the arrangements through which businesses promote the coexistence of uses in the marine environment. These may take the form of joint action and voluntary cooperation between economic actors, or consultation with sea users and their stakeholders.

A Planning for multiple uses of the ocean

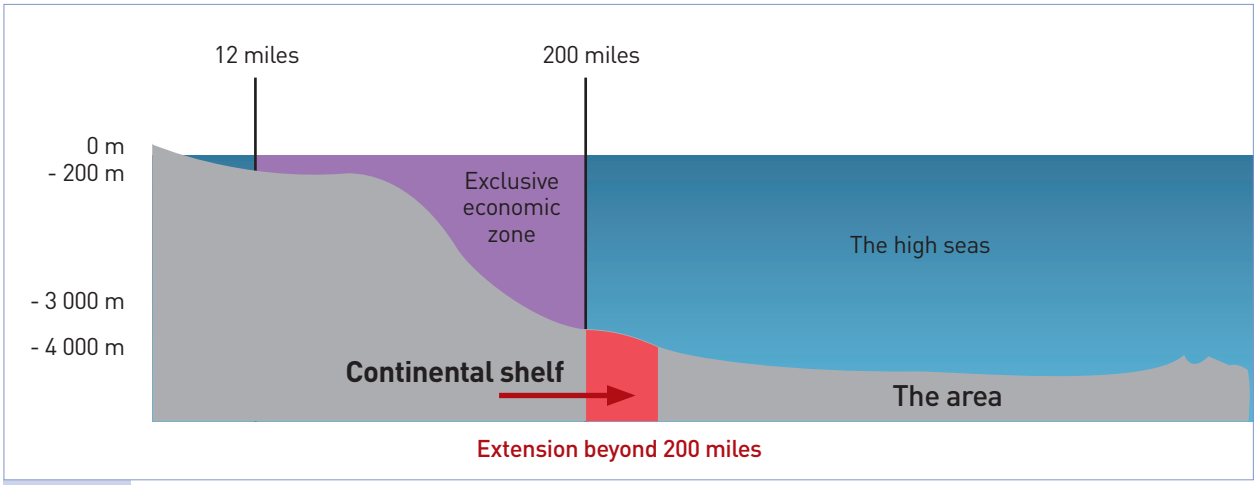


Figure 6

The different marine areas and their jurisdictions.
Source: Ifremer. © Extraplac

1 - Ocean governance - a mixed bag

Since the second half of the 20th century, the growing demand for resources and advances in technology have created the need for governance arrangements over maritime areas. The most important of these is the United Nations Convention on the Law of the Sea (UNCLOS), known as Montego Bay, which was adopted in 1982 and ratified by 168 countries in March 2021. This convention establishes the concept of exclusive economic zone (EEZ) where states can exercise their sovereignty over resources.

Countries may also submit requests to the Commission on the Limits of the Continental Shelf to extend the seabed over which their rights are exercised. Beyond that, the International Seabed Authority organises and oversees the management of the deep seabed as the common heritage of humanity. Its main activity consists in managing underwater minerals, including polymetallic nodules, sulphur chimneys and cobalt crusts.

Biodiversity on the high seas is being negotiated under the forthcoming BBNJ (*Biodiversity beyond National jurisdiction*)[46] agreement, which aims to supplement the various texts and agreements ratified since the Montego Bay Convention, in the absence of a treaty on biodiversity in extraterritorial areas. Negotiations have been conducted by the United Nations since 2016 via four successive intergovernmental conferences. The agreement under preparation could further support conservation and sustainable use by strengthening existing management frameworks, while establishing a framework for some economic activities at sea.

It covers four areas:

1. Marine genetic resources, including sharing of benefits derived from their use.
2. Management measures by area, including marine protected areas.
3. Environmental impact studies.
4. Capacity-building and marine technology transfer.

A number of institutions supplement the Montego Bay arrangements at regional or sectoral level. The United Nations Environment Program (UNEP) hosts 18 regional seas programmes[47] governed by various conventions (Barcelona Convention for the Mediterranean, Nairobi Convention for the East African Coast, etc.). The International Maritime Organization (IMO) regulates the shipowner community. Its actions include drawing up the Polar Code, a set of rules for ships operating in polar waters, cutting the maximum allowable sulphur content for fuels from 3.5% to 0.5% to improve air quality, and laying down an absolute emission reduction target of 50% by 2050, compared to 2008 (70% in intensity).

Private-sector businesses are also joining forces, spontaneously or at the behest of the authorities, to undertake collective actions towards a sustainable blue economy. For example, the United Nations Global Compact Sustainable Ocean Business Action Platform has developed principles and guidelines to promote sustainable exploitation of the ocean (see box).

«Accelerated Arctic ice melts puts local ecosystems into jeopardy and raises governance issues concerning access to resources», EPE publication
©Shutterstock

46 https://www.un.org/press/fr/highlights/BBNJ
47 https://www.unenvironment.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/why-does-working-regional-seas-matter

The United Nations Global Compact action platform for sustainable ocean business

The Action Platform for Sustainable Ocean Business brings together, since 2018, maritime companies, governments, scientific institutes, banks and investors, UN entities and NGOs. The objective is to establish a global framework and to implement actions to ensure better use of the ocean to achieve the 17 Sustainable Development Goals. Alongside government and civil society, the private sector has an important role to play in maintaining sustainable ocean by protecting the ecosystems affected by their operations, as well as contributing to the development of new products, services and business models.

The Platform's work mobilises a range of stakeholders to achieve 5 ambitions by 2030:

- *Sustainable seafood*
- *Set sail for decarbonized shipping*
- *Harnessing ocean electricity*
- *Mapping the Ocean*
- *End Waste Entering the Ocean*

A range of work is also being carried out to accelerate investment in sustainable maritime activities, including the development of a reference guide for the issuance of Blue Bonds and a working group of CFOs of companies with activities at sea.

Besides, the Platform mobilises public authorities, businesses, international initiatives and scientific experts to develop the protocols needed to accelerate sustainable marine spatial planning. This includes participating in the development of methods to facilitate stakeholder engagement and the sharing of maritime space among all actors.

The Sustainable Ocean Principles

The Sustainable Ocean Principles, produced in consultation with over 300 stakeholders, provide a framework for responsible business practices across all sectors and geographies. They build on and complement the ten principles of the UN Global Compact on human rights, labour standards, the environment and anti-corruption.

They allow companies with activities that directly or indirectly impact the ocean to integrate ocean-related risks and opportunities into their business strategy, risk management and communications. Companies also commit to act responsibly and transparently.

The Principles are accompanied by sector-specific guides to help industry players and investors align their activities with the Principles.

To date, the Principles have been signed by more than 75 companies and banks and are widely used as a reference tool for the issuance of «blue» financial products. As an example, the Norwegian Sovereign Wealth Fund (NBIM) uses the Principles to guide its investment strategy.

Companies of all sizes, sectors, countries and levels of maturity on ocean issues can sign up to these principles, as long as they implement a continuous improvement process:
https://www.unglobalcompact.org/take-action/action-platforms/ocean

2 - Use planning - first attempts and challenges

In its report on the ocean economy in 2030, the OECD noted the inability of the maritime community to deal effectively with the many pressures exerted on the ocean, ascribing it to a history of predominantly sectoral management of maritime activities. While a sector-based approach is necessary, it is insufficient, as one activity cannot be performed without taking the others into account. The high-level panel for a sustainable ocean economy considers that, while it is necessary to develop, maintain and enforce the strictest sectoral standards, coordination between different sectors is a key element[48]. It is essential to factor in the ecosystem and overlapping ecological scales. By preserving the quality of marine and coastal ecosystems, it is possible to sustain activities necessary for economic and human development (coastal fishing, shellfish farming, aquaculture, tourism, mineral resource development, renewable energies, electricity grids at sea, etc.).

48 https://www.oceanpanel.org/blue-papers/integrated-ocean-management

In recent years, many countries and regions have put in place strategic frameworks for better management of the seas and oceans within their EEZs. The High Level Panel on a Sustainable Ocean Economy has identified several criteria for successful integrated ocean management, from the development of tools and capabilities to address the lack of data and deliver effective policy-making, to the monitoring of actual implementation of existing mechanisms and agreements for territorial waters and beyond. Public-private partnerships and stakeholder commitment are also identified as criteria for success.

Marine Spatial Planning (MSP) is one of the tools for implementing an ocean strategy. Originally developed by Unesco's Intergovernmental Oceanographic Commission (IOC) based on an ecosystem management approach, MSP has enjoyed something of a revival over the last decade as a tool to organise uses and manage conflicts in the marine environment, against a background of mounting pressures and nature conservation concerns. Launched in 2017 by IOC and the European Commission, the global MSP initiative aims to develop new international guidelines on maritime spatial planning.

In France, the 2017 National Strategy for the Sea and Coastal Regions (SMNL) implements the framework directive for maritime spatial planning (DCPEM), adopted at EU level in 2014. SMNL sets out spatial planning targets for maritime areas, particularly in the form of "priority action maps", aimed at reconciling environmental conservation with the development of maritime economic activities. Four strategic shoreline documents (DSF) define it at regional level by demarcating maritime areas according to the main trends and uses in each, even though it is possible to have co-uses or several activities in the same place. Spatial planning priorities under this strategy are renewable marine energy, aquaculture and protected areas. Maps of marine protected areas and marine natural parks are also used to identify priority actions for each area.

Coastal areas hold the vast majority of resources used by the established and emerging sectors making up the ocean economy. This means businesses have to operate in a complex and multi-use environment. In these narrow coastal systems, the main challenge is to strike a balance between current and, at times competing, future uses, while finding a trade-off between the restoration of natural ecosystems and the development of infrastructure that impacts ecosystems.

In sum, the governance of maritime areas is characterised by multiple areas (land-sea interface, territorial or extraterritorial waters) where varied, even disparate, environmental standards prevail. In this context, voluntary actions are particularly important because they supplement public action.

«Six of the seven living turtle species are classified as endangered or critically endangered».
Source: WWF (https://www.wwf.fr/especes-prioritaires/tortues-marines)
©Shutterstock

Marine protected areas and the blue economy

The Mediterranean Sea is recognized as one of the world's 25 hotspots. However, only 9.68% of the Mediterranean is currently covered by marine protected areas (MPAs), of which only 1.27% have management plans, and only 0.03% by fully protected areas.

Competition for maritime space - for renewable energy, aquaculture, passenger and freight transport, and many other uses - will continue to increase in the future, reflecting the pressing need to manage our marine territories more coherently. Maritime Spatial Planning (MSP) aims to organize human activities at sea in an efficient, safe, and sustainable way.

MPAs are essential tools for environmental protection, particularly in the context of the pursuit of a Good Ecological Status (GES) objective for Mediterranean waters.
An effective MSP can significantly support the objectives of MPAs by :

- playing a crucial role in achieving Good Ecological Status in the Mediterranean Sea;
- Avoiding negative impacts in priority areas;
- minimizing negative impacts in larger areas of high ecological value.

MPAs are one of the main tools for ensuring the preservation and restoration of marine ecosystems. The presence of certain economic activities combined with measures to reduce their impact (shellfish farming, small-scale fishing, certain leisure sports, etc.) may be compatible with these objectives. However, this is not systematically the case for all activities (offshore wind farms, intensive marine fish farming, industrial fishing, etc.).

This issue is at the heart of the PHAROS4MPAs project, whose publications examine how maritime traffic, offshore wind farms, aquaculture, cruises, artisanal fishing, recreational fishing, and boating affect Mediterranean MPAs and propose strategic approaches to avoid or minimize their impacts.

Designated MPAs currently cover 9,68% of the Mediterranean (above), while those operating with a management plan cover just 1,27% (below)

Alliance to End Plastic Waste. A multi-stakeholder cooperation to fight against plastic waste

BASF develops technologies to produce plastics that are both efficient and sustainable, and to process them in a circular economy. This expertise and know-how led BASF to become a founding member of the Alliance to End Plastic Waste. As a non-profit organisation comprising companies from the entire plastics and consumer goods value chain (chemical and plastics producers, consumer goods companies, retailers and waste management companies), the Alliance brings together nearly 80 companies (including the French groups Total, Veolia and Suez). The Alliance aims to act directly in geographical areas where plastic pollution is causing damage.

This commitment is based on four pillars: infrastructures, innovation, education and wastes management at source. All of these must be mobilised and financed on a global scale. To this end, the Alliance has pledged to mobilise USD 1.5 billion by 2024.

With the support of several types of stakeholders (local authorities, entrepreneurs, NGOs, etc.), we have already launched some very concrete initiatives. The STOP Jembrana project in Bali, an example of this co-construction of innovative solutions, has enabled the implementation of a new waste management system that will serve 160,000 inhabitants.

It will enable the local community to collect, sort and sell their own waste. The Alliance to End Plastic Waste has also developed the End Plastic Waste Innovation Platform, a start-up incubator and accelerator based in Silicon Valley, Paris and Singapore and that aims to fund initiatives to improve the recycling, sorting and recovery of plastic waste

BASF's contribution, based on more than 150 years of innovation, is clear. We aim to improve the recycling of plastics - through Chemcycling® technology, for example - but also transparency and traceability along the entire value chain. These innovations are essential to create an integrated and global waste management system, and to tackle the whole phenomenon of pollution.

B Collective action by businesses

Since many years, businesses have acted through alliances, coalitions, and charters of individual and collective commitments to promote ecological transition. This drive echoes an awareness that, given the magnitude of the issues to be addressed, no single stakeholder has all the solutions.

Coupled with the specific context of the ocean is the challenge of overlapping uses and their interdependence. Voluntary and collective actions are all the more useful as some operations take place outside national jurisdictions.

1 - Voluntary commitments

UN Ocean Conferences are international negotiation meetings held between governments with the aim of working towards the attainment of Sustainable Development Goal 14. The first conference, organised in 2017 by Sweden and Fiji, led to the establishment of a partnership dialogue between states, business, foundations and NGOs, resulting in the creation of an "ocean community" as the counterpart of COP 21 Climate Action. More than 1,600 Ocean Voluntary Commitments[49] have followed the 2017 conference. Suez, for example, aims to "mobilise 83,000 workers worldwide in a series of collective and participatory large-scale waste-collection operations on beaches and shores," and to «deploy integrated and collaborative approaches to significantly reduce plastic discharges at sea and treat microplastics in wastewater».

49 https://oceanconference.un.org/commitments/

The *Our Ocean* conferences, launched in 2014 by the US, bring together every year representatives of governments from around the world, international institutions, NGOs, and businesses from the port and maritime sectors. They also draw concrete commitments from participants, such as the establishment of marine protected areas by governments.

2 - Alliances and coalitions

In the shipping sector, multiple initiatives coexist to achieve the ambitious objectives of the IMO. Banks for instance have pulled together to create the Poseidon Principles (see box). *The Getting to Zero Coalition*[50] comprises more than 140 businesses from the energy, transportation, finance and infrastructure sectors, including Engie, Société Générale and Total. Its aim is to launch zero-emission high-sea trading vessels by 2030, while remaining commercially viable in a highly competitive market.

The Alliance to End Plastic Waste, launched on 16 January 2019, is a non-profit organization made up of businesses that manufacture, use, sell, process, collect and recycle plastic. They have undertaken to contribute up to US$ 1.5 billion in infrastructure, innovation, education and cleaning-up projects (see box).

SOCIETE GENERALE

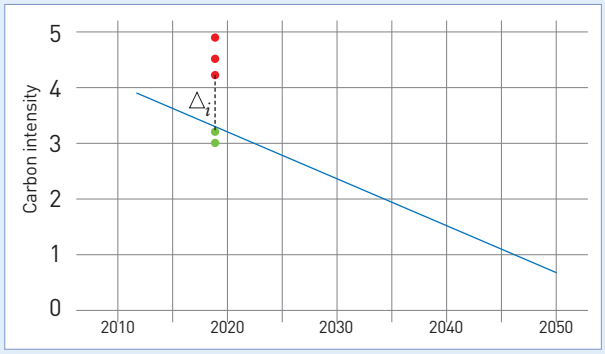
The Poseidon principles, a voluntary initiative of banks

Societe Generale is one of the founding signatories of the Poseidon principles. This initiative gathers 24 leading international financial institutions with total165 billion $ loans in the shipping transportations sector.

In cooperation with Global Maritime Forum, Poseidon Principles promote a low-carbon future for global industry by integrating climate issues in portfolios and credit decisions within banks. Poseidon Principles are part of IMO's commitment (International Maritime Organization) to reduce GHG emissions of at least 50% by 2050. Each signatory bank commits to publishing annually the alignment of their shipping financing portfolios with the target set by IMO. Thus, the energy efficiency of the financed ships becomes now guiding criteria in granting loans.

To assess portfolios alignment, a tool has been implemented to measure the difference between a ship carbon intensity and the carbon intensity required by IMO targets. The score of each signatory is illustrated in the annual report: the annual carbon intensity of a portfolio is represented by a point compared to the decarbonization trajectory of the Poseidon Principles (the point is green and under the line, if the score is better than the trajectory, in red and above the line otherwise). Decarbonization trajectories have been defined for each size and category of ships in order to compare ships between them.

Assessing alignment of the vessel level



«Societe Generale strengthens its long-run commitment in favour of energetic transition, as a founding signatory of the Poseidon Principles aiming at the compliance with strict environmental norms concerning decarbonisation of industrial maritime transportation. We are glad to guide our clients to hit their GHG emissions reduction targets». Paul Taylor, Head of Global Maritime & Offshore Transportation, Societe Generale. Vice-president of Poseidon Principles writing committee.

To go further:
https://www.poseidonprinciples.org/wp-content/uploads/2019/07/Poseidon_Principles.pdf

https://www.poseidonprinciples.org/wp-content/uploads/2020/12/Poseidon-Principles-Annual-Disclosure-Report-2020.pdf

50 https://www.globalmaritimeforum.org/getting-to-zero-coalition

3 - Consulting with coastal and sea users

In marine spatial planning processes, public and stakeholder participation has gradually become a key component of coastal and marine development projects.

While the public participation process is initiated by governments primarily to comply with regulatory requirements, it nonetheless elicits the voluntary participation of businesses, including energy providers who use it to promote offshore wind energy projects by drawing on their experience of land-based projects and adapting it to the specificities of the marine environment, which is both complex on account of the number of players and physically challenging.

The conditions for participation, the criteria for success, and the implementing principles have already been covered in a special 2016 EPE[51] study «Discussing with stakeholders», so we will not be returning to them here.

In the marine sector, several examples illustrate the variety of stakeholders and the importance of reaching long-term agreements. In one case, the design and layout of a wind farm were altered to accommodate fishery corridors. Multi-purpose platform projects involving floating wind turbines and aquaculture are under preparation, including the ENTROPI project backed by the EU as part of the H2020 programme, and RTE's multi-purpose scheme consisting of marine environmental monitoring and sea experiments and trials. In the Bay of Biscay, the Multi-Frame Project is examining not only the location of aquaculture and fishing activities within wind farms, but also development scenarios combining small-scale fishing and tourism. As on land, multi-use spaces and installations seem to be the solution to limit the occupation and takeover of maritime areas and to promote space and resource sharing. While more difficult to set up, they offer real benefits in terms of environmental footprint reduction.

The Rance tidal power plant: a long-term consultation

Inaugurated in 1966, the Rance tidal power plant produces electricity using hydraulic machines that turbine seawater at rising and falling tide. With an average annual generation of 500GWh, it supplies power to a city of around 300,000 inhabitants like Rennes. In addition to its energy production function, the plant is also an important player in the local economy: very busy road link between Saint-Malo and Dinard (30,000 to 60,000 vehicles/day); industrial tourism (~ 50,000 visitors/year); 41 direct local jobs (factory/lock) and around twenty local companies for maintenance; pleasure tourism (→ 20,000 boats per year pass the lock); lake created to accommodate more than 2,000 anchorages spread over ten sites; fishing area; effective protection against storms and possible risks of marine submersion in the estuary.

In terms of the environment, studies have shown that a new ecological balance has been found after about 10 years of operation. Indeed, the dam allows fish to pass and the site is suitable for bird sanctuaries. In 1994, EDF decided to reduce the maximum operating level from 13.5m to 12m because of a somewhat weakened third-party dike. A restrictive limitation for the operation of the plant, which also potentially generates impacts on the biodiversity and ecosystems of the estuary.

From 2015 to 2019, the State, Natura 2000 and EDF conducted consultations with local stakeholders in the territory to re-examine the highest and lowest water levels, with a view to a win-win agreement for all. Indeed, a drop in the foreshore, an area between the highest and the lowest tides, can lead to a loss of marine biodiversity in favour of terrestrial biodiversity. In addition, the many users of the estuary carry out their activity according to the tide levels.

A total of more than 70 structures (environmental associations, economic players, users, residents, elected officials, etc.) are involved in this consultation process led by a neutral third-party guarantor, supported by a technical committee and a steering committee, made up of representatives of the State, Natura 2000, elected officials, and EDF. Two days of testing enabled the steering committee to validate the new level framework, deployed in 2020, which will be the subject of a monitoring committee.

The whole difficulty lies in finding the right consensus in the face of often divergent interests: if the environmental stakes of the foreshore tend rather in favour of very limited low levels, it is rather the opposite concerning the stakes of the managers of infrastructure (pontoons, slipways, anchorages) and shore fishing.

51 http://www.epe-asso.org/environnement-et-sante-dialoguer-avec-les-parties-prenantes/

Le réseau de transport d'électricité

Dialogue with fishermen and underwater electrical links

In addition to submarine interconnections to build the Europe of electricity, RTE, the French Transmission System Operator, is responsible for the construction and financing of all connections to the electricity network of future offshore wind farms and is supporting the French authorities in the choice of the next preferential zones (public debates, technical and environmental studies, etc.). To date, 15 projects are currently under development or construction, 4 of them are using the promising new technology of floating wind power. RTE is now a major industrial operator at sea, with more than 200 employees dedicated to the development of offshore grid and an investment volume of €7 to 8 billion to reach 10,000 MW by 2035.

RTE is also taking advantage of these new responsibilities to extend its role as a sustainable developer from land to sea: in addition to numerous environmental or technological R&D projects, it is developing a wide range of partnerships in order to address the expectations of various stakeholders at sea.

In this respect, RTE has developed a close relationship with the historical users of the sea, namely fishermen. A partnership agreement was signed in 2013 with the National Fisheries Committee (CNPMEM), which was strengthened in 2017 by a good practices guide. This establishes a permanent dialogue at all stages of a project and aims to integrate fishing activities into the development of offshore networks (association with technical and environmental studies and certain technical choices, sharing of avoidance and mitigation measures, minimisation of the space at sea occupied for carrying out the work, the safety of sailors, communication methods during the operations phase, etc.).

Today, the relationship with the fishing industry has largely evolved and gained in maturity. If a dialogue seemed difficult at the beginning between developers and historical users of the sea, collective intelligence has made it possible to overcome obstacles, avoid misunderstandings and work hand in hand. This is how national or regional consultation bodies between RTE and fishing professionals came into being, and partnership agreements made it possible to involve fishing representatives in RTE projects very early (data collection, sharing of fisheries and environmental knowledge, support for developpers in understanding the fishing world), and it was possible to to set up a methodology for assessing economic impacts together.

Guide available on:
https://www.comite-peches.fr/wp-content/uploads/2017/12/Guide-Bonnes-pratiques-RTE-Comit%C3%A9s-p%C3%AAches-1.pdf

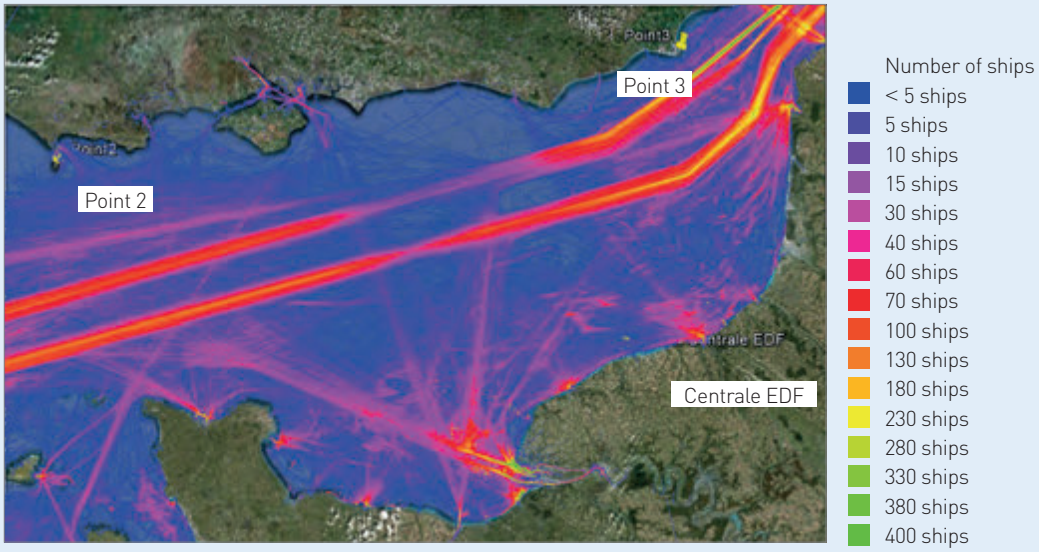
Rance tidal power station.
© EDF

Ocean as a new territory – a new space to share, a futur place to live

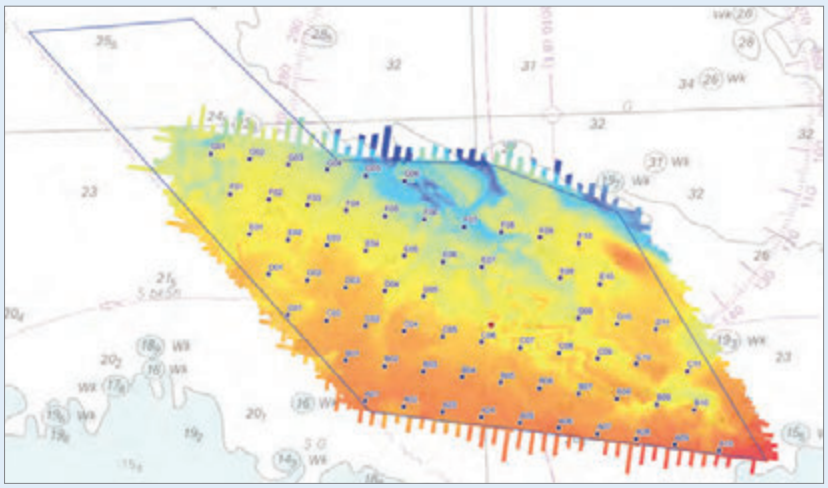
As the construction of the offshore wind farm begins off the coast of Courseulles sur Mer, it is important to remember that this project is the result of 13 years of development in permanent link with the territory and its stakeholders. This park, which will see the installation and the operation for nearly 30 years of 64 turbines for a total power of 450 MW, extends over a perimeter of 45 km² approximately. It is part of a maritime space already constrained by maritime activities, by a strong heritage and cultural context and within a fragile and, partly, protected coastal ecosystem.

This consultation, for example and after 8 years of work and exchanges , made it possible to adapt the project to the contingencies of the fishery: area choice, the layout of the turbines, siting restrictions, alignment of the turbines and cables route are all parameters that have been adapted to the local constraints. Pending the relevant authorizations, the selected project makes it possible to consider scallop fishing between the wind turbine alignments.

This territorial link also represents an important heritage and cultural component because the site is located right in front of the D DAY beaches and in the middle of historical wrecks. In collaboration with the Department of Underwater Archaeological Research (DRASSM), the project systematically listed any object on the seafloor and investigated all echoes likely to represent a heritage interest.



Vessel traffic in the Central and Eastern Channel - April 2013 (EDF-RE).



Layout of the wind turbines at Courseulles sur Mer. (EDF RE - Offshore wind turbines in Calvados)

Conclusion

The foregoing chapters confirm that global economic and human development is increasingly based on the ocean for food, transport, energy, various intangible services, and now for regulating the earth's climate. As a result, more and more businesses generate part of their value creation from sea-related activities and, consequently, are facing questions about how they conduct those activities.

This growing dependence is not without consequences: increased pressure on ecosystems is causing their rapid deterioration. One of the challenges of the coming decade will therefore be to find land-based solutions that prevent the physical and ecological degradation of marine environments and limit our footprint to sustainable levels at sea.

Our publication aims to accelerate and broaden this awareness. The issue does not concern only maritime businesses; entire economic sectors are directly or indirectly impacted or impactful. Moreover, because ocean governance is something of a mixed bag, voluntary action is important and sometimes decisive to address ocean issues that fall outside the scope of national regulations.

EpE member companies have already devised solutions contributing to more sustainable management, including land-based prevention of pollutant discharges and plastic waste, restoration of marine and coastal ecosystems, spatial monitoring of vessel movements, fish stocks and ecosystem health, infrastructure adaptation, decarbonisation financing, and so on.

They have engaged in dialogue with their value chains, the scientific community and their stakeholders to roll out solutions on a much larger scale, while managing conflicts of use often through management schemes that balance uses to save space and optimise resources.

The idea that ocean challenges are of a fundamentally collective nature, from use planning to solution development, is gradually gaining ground. Many of the business practices described here illustrate this point.

Furthermore, work could be more closely coordinated with governments, on territorial waters and beyond, to foster viable and fair economic models in what is the most competitive environment of all. Regulation of land-sea interfaces, research, public orders, quantified objectives, cooperative projects, and regulatory compliance are some of many levers available to public institutions to step up private-sector action.

Like the atmosphere, the ocean is unique. We are all in this together, and so are responsible for keeping this immense living system running in a manner that allows human life on earth. The fact is we are all in the same boat.

Attachments

Abbreviations

LCA	Lifecycle Analysis
AIS	Automatic Identification System
MPA	Marine Protected Area
BBNJ	Biodiversity Beyond National Jurisdiction
EIB	European Investment Bank
UNFCCC	United Nations Framework Convention on Climate Change
CMF	Cluster Maritime Français (French Maritime Cluster)
CNES	Centre national d'études spatiales (National Centre for Space Studies)
IOC	Intergovernmental Ocean Commission
DCPEM	Directive-cadre pour la Planification de l'espace maritime (Framework Directive for Marine Spatial Planning)
DCSMM	Directive-cadre Stratégie pour le milieu marin (Framework Directive for Marine Environment Strategy)
DSF	Documents stratégiques de façade (Strategic Shoreline Documents)
MRE	Marine Renewable Energies
ESG	Environmental, Social and Governance
FAO	Food and Agriculture Organization
IPCC	Intergovernmental Panel on Climate Change
LNG	Liquefied Natural Gas
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
MEA	Millennium Ecosystem Assessment
MSP	Marine Spatial Planning
OECD	Organization for Economic Co-operation and Development
SDG	Sustainable Development Goals
IMO	International Maritime Organization
PEM	Planification de l'espace maritime/marin (Maritime Spatial Planning)
UNEP	United Nations Environment Programme
R&D	Research and Development
ES	Ecosystem Services
SNML	Stratégie nationale pour la mer et le littoral (National Sea and Coastal Strategy)
UNCLOS	United Nations Convention on the Law of the Sea, known as Montego Bay
UNEP FI	United Nations Environment Program Finance initiative
UNGC	United Nations Global Compact
EEZ	Exclusive Economic Zone

Bibliography

Note:

- **IDDRI *Ocean Programme* publications and reports**
  www.iddri.org/fr/programme/ocean
- **United Nations Global Compact (UNGC) *Sustainable Ocean Business Action Platform* guides and publications https://www.unglobalcompact.org/take-action/action-platforms/ocean**
  https://unglobalcompact.org/take-action/practical-guidances-for-the-un-global-compact-sustainable-ocean-principles
- **High-Level Panel for a Sustainable Ocean Economy publications**
  www.oceanpanel.org/

World Bank, *Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition*, 2020
https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action

European Commission, *The EU Blue Economy Report 2020*
https://blueindicators.ec.europa.eu/sites/default/files/2020_06_BlueEconomy-2020-LD_FINAL-corrected-web-acrobat-pro.pdf

FAO, The State of World Fisheries and Aquaculture. *Achieving the Sustainable Development Goals*, 2018
http://www.fao.org/3/i9540fr/i9540fr.pdf

Fondation de la Mer, *Référentiel Océan*, 2020
www.fondationdelamer.org/referentiel-ocean/

Fondation de la Mer, *Baromètre de la maritimisation de l'économie*, 2017
http://www.fondationdelamer.org/barometre/

Fondation Heinrich Böll, *La Fabrique écologique, Atlas du Plastique*, 2020
https://fr.boell.org/fr/2020/02/24/atlas-du-plastique

IPCC, *Special Report on the Ocean and the Cryosphere in the context of Climate Change*, 2020
https://www.ipcc.ch/site/assets/uploads/sites/3/2020/07/SROCC_SPM_fr.pdf

OECD, *The Ocean Economy in 2030*, 2016
https://www.oecd.org/environment/the-ocean-economy-in-2030-9789264251724-en.htm

OECD, *Rethinking Innovation for a Sustainable Ocean Economy*, 2019
https://www.oecd-ilibrary.org/science-and-technology/rethinking-innovation-for-a-sustainable-ocean-economy_9789264311053-en

Ocean Energy Europe, *Ocean Energy – Key trends and statistics 2019*, March 2020
https://www.oceanenergy-europe.eu/wp-content/uploads/2020/03/OEE_Trends-Stats_2019_Web.pdf

Ocean Climate Platform, *Ecosystem Services of the Deep Ocean*, 2016
https://ocean-climate.org/locean-profond/

Responsible Investor & Credit Suisse, *Investors and the Blue Economy*, March 2020
https://www.responsible-investor.com/reports/responsible-investor-and-credit-suisse-or-investors-and-the-blue-economy -

The Economist Group's World Ocean Initiative, *A sustainable ocean economy in 2030*, 2020
https://ocean.economist.com/woi-sustainable-ocean-economy-2030/

UNGC, *Seaweed Manifesto Report*, 2020
https://unglobalcompact.org/library/5743

United Nations Environment – Finance Initiative, *The Rising Tide: Mapping Ocean Finance for a New Decade*, 2021
https://www.unepfi.org/publications/rising-tide/

Acknowledgements

This brochure is the product of studies carried out by EpE's Ocean Commission which met between 2018 and 2021, under the chairmanship of Emmanuel Martinez, Chief Environmental Economist at Société Générale. Written by EpE, it collects the experience and best practices of EpE members, along with insights from many environmental health experts. EpE thanks the representatives of member companies who have shared their experience and participated in work meetings. EpE also thanks the experts, scientists and representatives of public authorities and associations for their contributions to this publication (some of which have been reproduced), as well as for their work in the commission, which has stimulated the thinking and actions of our member companies. Thanks are also due to Annie Aujon-Aleksy (octobre-novembre agency), Laura Azoulay, Sylvie Gillet, Léa Maisonneuve and Jean-François Mathieu for their respective contributions. EpE thanks David Laurent, Head of the Climate & Ocean Department, for coordinating and writing this study, and Govind Bhinder of FEAT for the English translation.

Claire Tutenuit,
CEO of EpE

About EpE

Entreprises pour l'Environnement (EpE), a French association set up in 1992, is a forum for dialogue between business leaders, environmental managers and policymakers who share the vision of the environment as a source of transformation, progress and opportunity, exchange their best practices and work together to better factor the environment into their strategies and operations.

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The sea, the environment's and the global economy's new frontier

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