



Proposed Mission: **Mission Starfish 2030: Restore our Ocean and Waters**

Report of the Mission Board
Healthy Oceans, Seas, Coastal and Inland Waters

Independent
Expert
Report



Mission Starfish 2030: Restore our Ocean and Waters

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This document is the Mission Board's proposal to the European Commission for a
mission on healthy oceans, seas, coastal and inland waters.

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MISSION STARFISH 2030: RESTORE OUR OCEAN AND WATERS

Healthy ocean and waters are taken for granted. Yet, they are in trouble and need to be restored. We call on all European citizens and policy makers to take responsibility for protecting and regenerating rivers, lakes, seas and ocean and demand urgent systemic change from our politicians and leaders.

1 Healthy Ocean and Waters: A Public Good

The ocean, seas, coastal and inland waters form a single system – the water cycle¹, which covers around 75 percent of the Earth's surface². **All forms of life depend on it**, and in particular:

- The hydrosphere provides us with the water we drink, the air we breathe and the food we eat. All our drinking water, half of the oxygen produced on our planet and around one sixth of the animal protein we eat comes from the ocean and waters.
- It regulates our climate and our weather. Ocean and waters absorb, store, and transport the heat supplied by the sun. The organisms that live in them use sunlight to transform inorganic carbon into biological material. They are the planet's largest and most important carbon sink and its ecosystems buffer the impacts of global warming, absorbing 26 percent of anthropogenic CO₂ and around 93 percent of the excess heat produced by global warming during the period 1971-2010.
- The ocean and waters are home to hotspots of global biodiversity and the planetary genome and provide us with essential goods and services (energy, novel medicines, raw materials, transport, and food).
- They are a place of leisure, well-being and growing blue economy and trade. Over 40 percent of the EU population lives in coastal areas, where marine and freshwater environments are interlinked with culture, identity and sense of belonging.

Our ocean and waters are public goods. We are all responsible, individually and collectively, for their protection and health. This requires changing our perspective and considering the ocean and waters as having a value that needs

¹ Heated by the sun, water evaporates from land and sea into the atmosphere where it cools and condensates. From the atmosphere, water is released back into sea and land through rain and snow. On land, water runs off through rivers or below the surface as groundwater back into the sea. In this continuous process, water changes through solid, liquid and gaseous states, but the total amount of water in the system remains constant. Around 96.3 percent of the world's water can be found in the ocean, with 1.93 percent stored in glaciers and ice caps, 1.75 percent in groundwater and only around 0.02 percent in surface water.

² Pieri, D.C. et Dziewonski, A.M.. 2007. "Earth as a Planet: Surface and Interior" in McFadden et al. eds. *Encyclopaedia of the Solar System*. Elsevier Academic Press, Amsterdam: pp.189-193.

constant replenishing, not depleting. This value is more than the economic benefits they provide. It entails ecological, societal and cultural benefits.

But humans are embedded in the ecology of the planet. We rely on natural ecosystems to provide various services, but we also have direct and indirect influences on these systems, potentially harming them. However, we have the means to safeguard them, if we choose to. And we must.

In other words, our ocean and waters are a **natural capital**, which must be considered essential for our well-being and prosperity. **Without healthy ocean and waters, there is simply no life on Earth.**

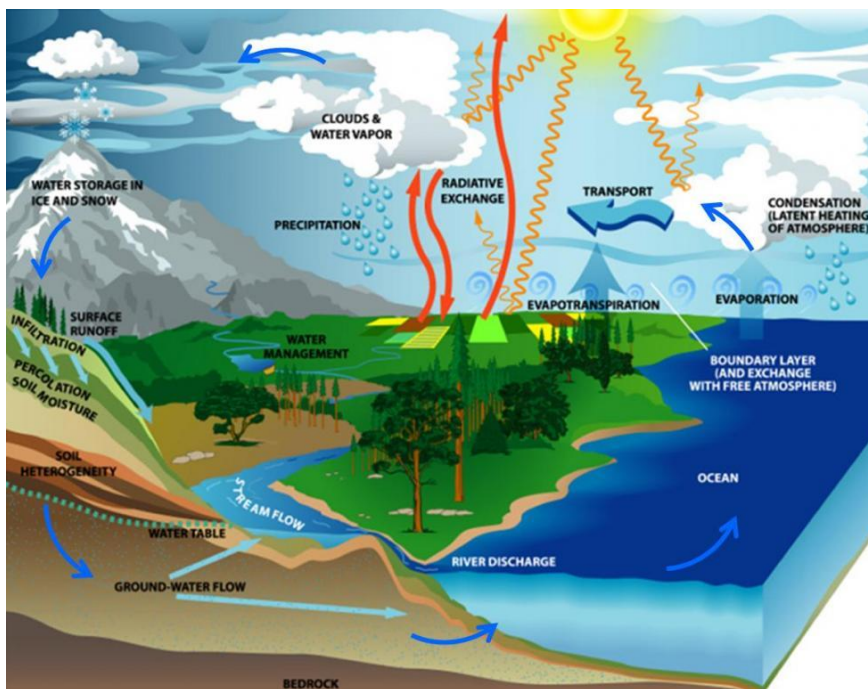


Figure 1. Main elements of the water cycle³

However, today, at every stage from 'source to sea', **the entire water cycle is under pressure like never before.** Decades of pollution and damaging uses have severely degraded the condition of aquatic ecosystems. Climate change and ocean acidification come as additional, cumulative pressures, while the capacity of the ocean to regulate the Earth's climate is fundamentally threatened.

³ Source: <http://archive.sswm.info/pt-pt/category/concept/water-cycle>

Restoring and protecting our ocean and waters is one of the urgent and defining tasks of our time. We owe it to ourselves and to future generations. For too long, our society has been disconnected from and oblivious of the water cycle's existential role and value, largely unaware of the importance of water bodies for our health and providing insufficient political and financial investment to safeguard the benefits they provide to our life on Earth. We need to step up and restore the capacity of aquatic ecosystems to contribute to climate mitigation and adaptation as well as conservation and restoration of biodiversity⁴. As degraded ecosystems take a long time to recover, we must take adequate actions now to enable a healthy and thriving ocean and waters for the next generation.

The Covid-19 crisis is a wake-up call. Fundamental systemic change towards sustainability and resilience needs to emerge from design, with sustainable management and active restoration at its core. In recovering from the Covid-19 pandemic and the crises it has caused, we must reorient our economies and societies towards our long-term objectives, **with a changed frame of mind about our relationship with nature and economic growth**, to create the future we want for our ocean and waters.

Over the years, the European Union (EU) has put in place several policies and tools to respond to this challenge and is now stepping up its ambition with the European Green Deal⁵. The European Green Deal sets the path for Europe to become the first climate-neutral continent by 2050 and aims to transform the EU into a fairer, cleaner and greener society. In this context, the EU has identified Missions as a powerful tool to lead the transformative changes needed on our planet and within our societies. This Mission focuses on developing systemic and transformative solutions for "healthy oceans, seas, coastal and inland waters".

The Missions

Inspired by the Apollo 11 mission to put a man on the moon, 'moon-shot' Missions seek to enable large-scale transformations in key areas through bold, concrete, game-changing solutions, which provide public goods to Europe's citizens. They find their legal basis in the Horizon Europe Regulation, which outlines a set of criteria. Missions set a clear, measurable and time-bound target, thus focusing and integrating actions on a common goal. This goal must be inspirational, linked to a key societal challenge and relevant to a broad range of stakeholders and citizens. Missions link initiatives across different disciplines, mobilise policymakers, stakeholders and citizens, and leverage public and private investments towards a common target. Indeed, research and innovation can play a central role in accelerating the necessary transitions and should act as a key catalyst for transformation in a rapidly globalising world, where success depends ever more on the production and conversion of knowledge into innovation⁶. However, for this effort to bear lasting and transformational fruit, it will have to

⁴ See reports from IPCC and IPBES: *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. In press, 2019; *Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. IPBES secretariat, Bonn, Germany, 2019.

⁵ COM(2019) 640 final, [https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM percent3A2019 percent3A640 percent3AFIN](https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%2019%20640%20final)

⁶ 2017. LAB – FAB – APP Investing in the European future we want: report of the independent High Level Group on maximising the impact of EU Research & Innovation Programmes.

go hand-in-hand with major policy and behavioural changes, which go beyond science and its developments.

The European Commission has set up an advisory Mission Board composed of up to fifteen experts from innovation, research, policymaking, civil society and relevant organisations to advise on the scope and objectives of the Mission. The work of the Mission Board is further supported by an Assembly, gathering a larger number of high-level experts to provide an additional pool of ideas, knowledge and expertise.

The Mission “Healthy oceans, seas, coastal and inland waters” aims to know, restore and protect our ocean and waters by 2030, by reducing human pressures on marine and freshwater environments, restoring degraded ecosystems and sustainably harnessing the essential goods and services they provide. Protection and conservation efforts must address the entire ocean and water system in a holistic fashion, if they are to succeed. The future we must collectively create will be defined by who we perceive ourselves to be in relation to the natural capital of our oceans and waters, guiding the choices we now make. Inspired by the shape of the starfish, the Mission pursues five interdependent objectives – knowledge, regeneration, zero pollution, decarbonisation and governance – uniting overall 17 ambitious, concrete and measurable targets for 2030.

To know, restore and protect our ocean and waters will be key to reach the European Green Deal objectives and to contribute to the implementation of the United Nation’s 2030 Agenda for Sustainable Development and the Decade of Ocean Science, enabling Europeans to shape a desirable and prosperous future. The Mission will further be a powerful element in the post-Covid-19 recovery and the transformation towards a more healthy and resilient society.

2 The Ocean and Waters Are Under Threat

Our society’s relationship to the ocean and waters is inherently unsustainable, severely challenging the health of our ocean, seas, coastal and inland waters. Climate change and ocean acidification come as additional pressures. In turn, the capacity of the ocean to regulate the Earth’s climate is jeopardized. As a result, over 85 percent of wetland areas have been lost⁷, and 66 percent of the ocean area is experiencing increasing cumulative impacts. One million species – aquatic and terrestrial – are at risk of extinction⁸. At the same time, the tools at our disposal to restore and manage the aquatic systems are significantly imperfect, due to a lack of knowledge and lack of public connection to the ocean and waters on the one hand, and due to poor governance on the other. The Mission proposes a systemic vision of all of these challenges and how to address them.

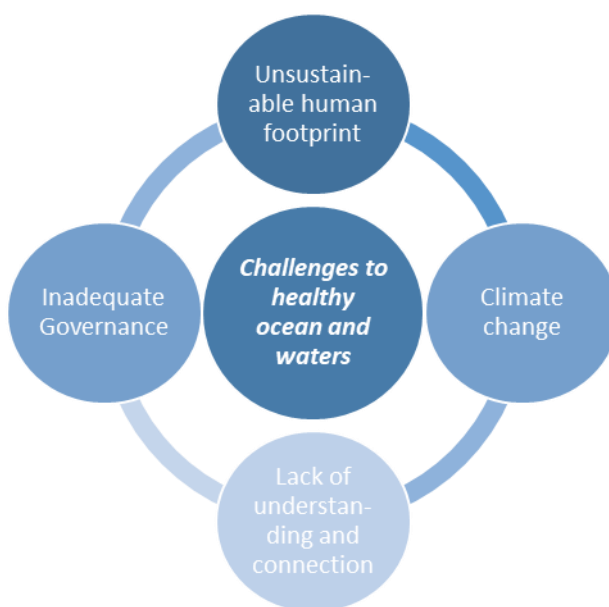


Figure 2. Main challenges to healthy ocean and waters

2.1 *Unsustainable human footprint*

The first challenge is the degradation of ocean and freshwaters ecosystems stemming from human activities at sea and on land, with both direct and indirect impacts.

⁷ IPBES 2019, *ibid.*

⁸ Over an estimated total of 8.1 million species.

Pollution

Pollution is degrading all parts of the water cycle from the top of the mountains to the bottom of the ocean. 60 percent of EU surface waters are not meeting the Water Framework Directive's standards for sustainable management and the protection of unique and valuable habitats as well as of drinking and bathing water⁹. Moreover, the State of the Environment Report 2020¹⁰ considers the achievement of good environmental status (GES) of European marine waters by 2020 unlikely¹¹, while the status of European freshwaters has little progressed over the last 10-15 years. Pollution of our ocean, seas and freshwaters is caused by four major sources.

Eutrophication is a process driven by the excessive enrichment of water by nutrients, especially nitrogen and phosphorus. Though nutrient inputs from urban wastewater have significantly decreased, inputs from agricultural activities (mainly fertilisers) continue to threaten the health of our coastal and surface waters. Eutrophication leads to increased algal production, alters the balance of organisms and degrades overall water quality. As a result, major parts of the Baltic Sea and the Black Sea show poor oxygen levels.

Another major pressure on freshwater and marine ecosystems is the discharge, loss and leakage of **contaminants**¹². Pesticides, biocides, persistent organic pollutants, heavy metals, radioactive substances and pharmaceuticals primarily originate from land-based sources, while atmospheric deposition and sea-based activities (i.e. shipping, oil and gas extraction and resuspension from bottom-touching activities) also contribute to contamination. Water contamination is highest in coastal waters, and substances accumulating in fish and seafood may become a source of toxic pollutants for humans¹³.

New substances resulting from human activity are constantly appearing and are believed to cause adverse effects on ecosystems and humans. Pharmaceuticals are an example of emerging, hence little-known contaminants¹⁴, with potentially serious threats to human health and ecosystems. In general, these **micro pollutants** encompass a wide variety of substances that are characterised as small, persistent and biologically active, found in aquatic environments in low concentrations and can have detrimental effects on humans, the environment or

⁹ Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1-73.).

¹⁰ EEA, 2019. *The European environment - State and outlook 2020: Knowledge for transition to a sustainable Europe*. Luxembourg: Publications Office of the European Union.

¹¹ The EU designed the Marine Strategy Framework Directive³ (MSFD) as a holistic policy to protect the marine environment of the seas around Europe while enabling the sustainable use of marine goods and services. The MSFD has been in force since 2008. It requires Member States to set up national marine strategies to achieve, or maintain where it exists, 'good environmental status' by 2020, see Implementation Report COM (2020) 259 final from 26.6.2020.

¹² 93 percent of assessed areas in Europe are contaminated by hazardous substances. EEA, 2018. Contaminants in Europe's seas. EEA Report No 25/2018.

¹³ EEA 2018. Ibid.

¹⁴ The European Commission acknowledged the importance of this issue with the "Strategic Approach to Pharmaceuticals in the Environment" (COM/2019/128 final), emphasizing the need of gathering monitoring data as an important prerequisite to develop an appropriate risk assessment of such emerging pollutants.

drinking water supplies. Micro pollutants also appear in groundwater. Thanks to the protective barrier of the soil, groundwater is less exposed to pollution, but it recovers very slowly, much slower than lakes and rivers.

Marine litter is a particularly pervasive, worldwide pressure – present on beaches and coastlines, on the sea surface as well as on the seabed. Marine litter mostly comes from land and is transported by rivers, but sea-based activities like shipping and fishing further contribute to the problem. Plastic is the most abundant and damaging component of marine litter due to its longevity¹⁵. Marine plastic pollution has increased tenfold since 1980 and each year between 4.8 and 12.7 million tonnes end up in the ocean¹⁶. Some estimate that by 2040, 20 million tonnes of plastics will be entering the ocean per annum¹⁷. Marine litter harms ecosystems, through litter ingestion, entanglement, accelerated invasions of non-indigenous species and potential toxicity of released chemicals from plastics and micro-plastics. Although clean-up actions can be meaningful, the main action has to be prevention at source¹⁸.

Increasing attention is given to another source of pollution, **underwater noise**, which adversely affects the health of marine species and biological productivity. The main source of continuous noise is maritime traffic, while the main sources of impulsive noise are pile driving (construction), seismic exploration with airguns, explosions, and sonar systems¹⁹.

For most of the above-mentioned types of pollution, the main sources are located on land or in coastal areas, not at sea. An integrated land-sea approach is therefore imperative.

¹⁵ EEA, 2019. *Multiple pressures and their combined effects in Europe's seas*. ETC/ICM Technical Report 4/2019: European Topic Centre on Inland, Coastal and Marine waters, 164 pp.

¹⁶ Jambeck, J. et al. 2015. "Plastic waste inputs from land into the ocean", *Science*, Vol. 347(6223): pp. 768-771.

¹⁷ Source: https://www.pewtrusts.org/-/media/assets/2020/07/breakingtheplasticwave_report.pdf

¹⁸ As recognized by G7 and G20 countries. G7, 2018. G7 Ocean Plastics Charter, https://www.consilium.europa.eu/media/40516/charlevoix_ocean_plastic_charter_en.pdf; G20, 2017. G20 Action Plan on Marine Litter: https://www.g20germany.de/Content/DE/Anlagen/G7_G20/2017-g20-marine-litter-en_blob=publicationFile&v=4.pdf

¹⁹ EEA 2019. Ibid.

Unsustainable exploitation of sea and water resources

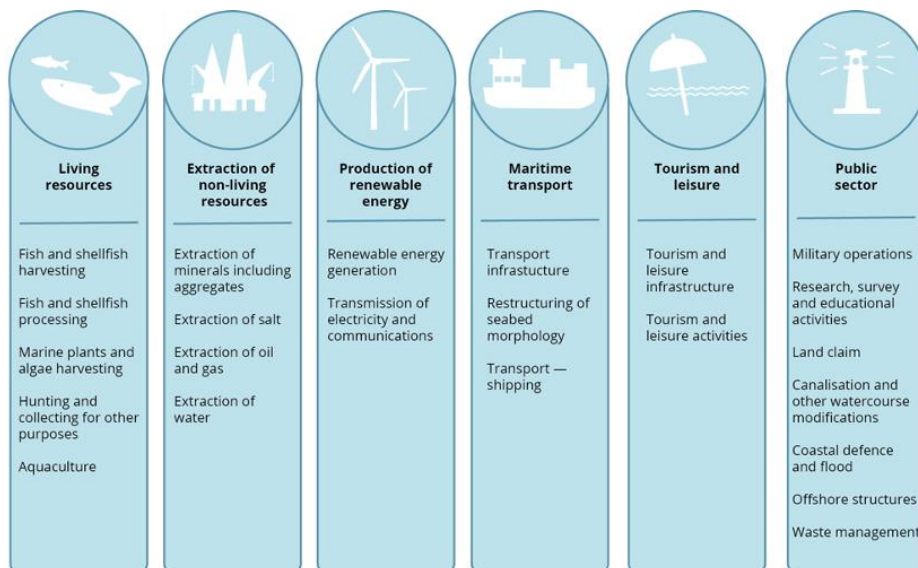


Figure 3 – The multiple uses of the sea²⁰

In 2018, total world **fisheries** reached a record of 96.4 million tonnes, with catches from inland fisheries amounting to 12 million tonnes, their highest level ever²¹. Globally, only 6.2 percent of fish stocks are underexploited²². In the EU, even though overall, the EU fleet shows good economic performance²³ and there are clear and important signs of improvement in the North-East Atlantic Ocean and Baltic Sea²⁴, the situation remains critical in the Mediterranean and Black Seas²⁵. This is mainly due to the prevalence of overfishing and a significant lack of knowledge of the status of fish and shellfish stocks.

Moreover, harmful subsidies increasing fishing capacity and illegal, unregulated and unreported (IUU) fishing are widespread, non-transparent and not regulated at international level. As a result, fisheries in the high seas are becoming increasingly dependent on harmful subsidies, thereby harming fragile

²⁰ Source: <https://www.eea.europa.eu/media/infographics/marine-messages-ii-classification-of/view>

²¹ FAO. 2018. *The State of World Fisheries and Aquaculture 2020*.

²² FAO. 2020. *The State of World Fisheries and Aquaculture 2020. Sustainability in action*. Rome.

²³ The European Commission recently reported a net profit of around €1.4 billion and an average net profit margin of 18 percent. This is a great improvement, given that the EU fleet was only marginally profitable in 2008. However, significant differences across the different EU fishing regions persist, being the Baltic, the Mediterranean and Black Sea those with lower profitability levels (COM(2020) 248 final).

²⁴ 62.5 - 87.5 percent of stocks meet at least one of the good environmental status criteria in these regions. (EEA. 2019. *Status of marine fish and shellfish stocks in European seas*. <https://www.eea.europa.eu/data-and-maps/indicators/status-of-marine-fish-stocks-4/assessment>. Accessed on 6 July 2020.)

²⁵ Only 2 out of 33 stocks (6 percent) in the Mediterranean Sea and 1 out of 7 stocks (14.3 percent) in the Black Sea meet at least one of the good environmental status criteria (EEA. 2019. *Status of marine fish and shellfish stocks in European seas*. <https://www.eea.europa.eu/data-and-maps/indicators/status-of-marine-fish-stocks-4/assessment>. Accessed on 6 July 2020.)

ecosystems. Furthermore, unsustainable fishing practices such as bottom trawling and discarding of unwanted species severely degrade benthic ecosystems²⁶, alter biodiversity, and modify water circulation.

Despite promising growth opportunities and its potential to provide a low-carbon and low-impact source of proteins, **aquaculture** is not without impacts and limitations. Eutrophication, biological contamination, an overall dependence on animal feeds and competition for space with other activities limit possibilities for sustainable growth. New technologies, cultivation methods and lower trophic level species may minimise the ecological impacts of aquaculture and even increase their contribution to the preservation of aquatic systems.

However, we must not forget that the production of aquatic biomass sustains the livelihood for and contributes to the food security of many communities around the world. Globally, 59.5 million people work in the fisheries and aquaculture sector and 3.3 billion people rely on fish for 20 percent of their protein²⁷. But it will not be possible to feed a growing global population with diminishing resources endangered by pollution and unsustainable production practices.

Beyond fisheries and aquaculture, coastal and maritime **tourism** puts great pressure on land and water and is further linked to high CO₂ emitting sectors (transport, accommodation). Inherently depending on the quality of the environment, the tourism sector thereby ultimately undermines its own success. By contrast, a sustainable coastal tourism relying on local supply chains and regeneration can significantly contribute to the protection of coastal and underwater heritage.

Overall, about 23 percent of the entire European seabed and 43 percent of its shelf area habitats are under some form of physical disturbance²⁸. In particular, sand and gravel **extraction, seabed mining, dredging** for the construction of offshore installations and for harbour maintenance purposes, coastal **construction** and **dumping** at sea often damage large swathes of the seabed and affect fragile species. If not well planned, the laying of electric energy and telecommunication cables and natural gas pipelines may also disturb ecosystems.

Human activities have also produced multiple pressures on **freshwaters**. The Biodiversity 2030 Strategy²⁹ recently adopted by the European Commission states that *'the EU's legal framework on water is ambitious but implementation is lagging behind and enforcement must be stepped up. Greater efforts are needed to restore freshwater ecosystems and the natural functions of rivers in order to achieve the objectives of the Water Framework Directive'*³⁰.

²⁶ The benthic zone is the ecological region at the lowest level of a body of water such as an ocean, lake, or stream, including the sediment surface and some sub-surface layers.

²⁷ FAO 2020, Ibid

²⁸ EEA 2019. Ibid.

²⁹ COM(2020)380 final from 2 June 2020

³⁰ Directive 2000/60/EC

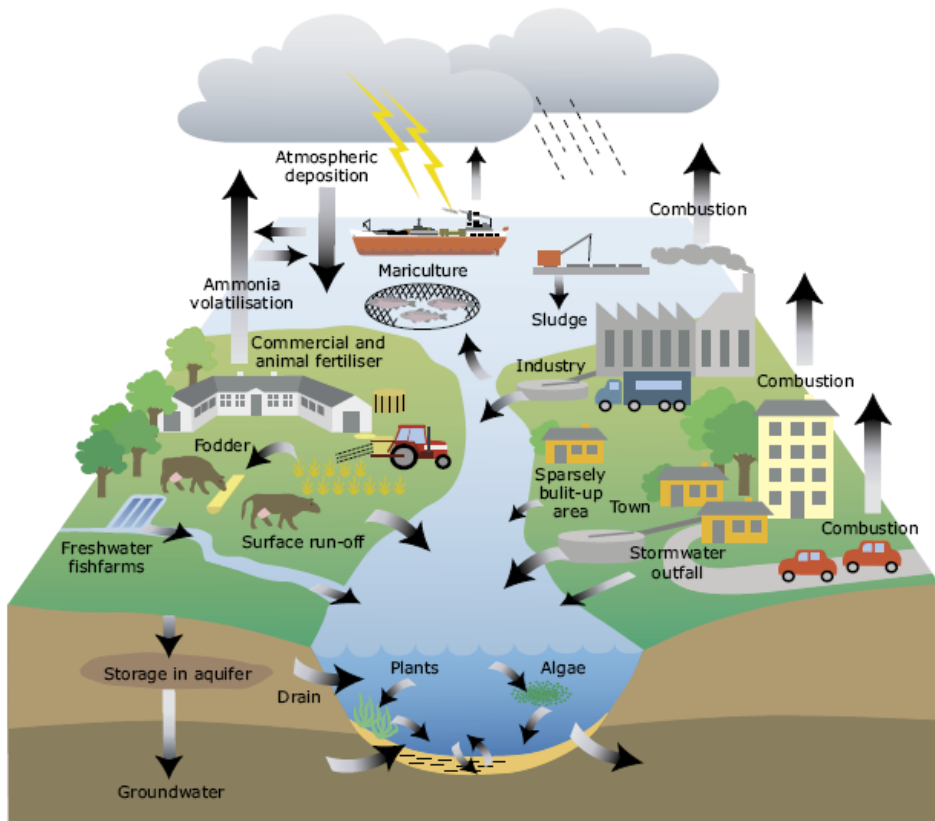


Figure 4. Overview of the land aquatic cycle and sources of pollution³¹

Changes in landscapes, growth in food and energy production and the movement of people into urban areas alter the quantity and quality of our freshwater resources. Hydro-morphological pressures³², diffuse pollution and water abstraction have impaired freshwater ecosystems and are reducing the amount of runoff water that reaches the world's oceans. New infrastructure disrupts the natural flow of rivers and the condition of lakes, while in many places, the level of groundwater is falling and lakes are drying up³³.

Today, 65 percent of global rivers are considered as being under moderate-to-high threat in terms of human water security and biodiversity. Since the beginning of the twentieth century, more than 800.000 dams have been built to facilitate increased withdrawals, and currently 75 percent of the main rivers are fragmented. Some large river basins have seen their flow reduced by almost 75

³¹ Source: <https://www.eea.europa.eu/archived/archived-content-water-topic/water-pollution/figures-and-maps/sources-of-pollution/view>

³² Hydromorphology considers the physical character and water content of water bodies. Good hydromorphological conditions support aquatic ecosystems (i.e. hydromorphological elements such as water flow and substrate provide physical habitat for biota such as fish, invertebrates and aquatic macrophytes). Pressures can include abstraction, impoundment (i.e. dams and weirs), channelisation and embankments.

³³ Source: <https://earthobservatory.nasa.gov/images/146888/signs-of-drought-in-european-groundwater>

percent over 30 years due to increasing water extraction³⁴. Moreover, the flows of many rivers are not sufficient to sustain the deltas, the consequences are losses in fish biomass and biodiversity, as well as coastal erosion due to a great decrease of sediment load.

In the coming decade, a crucial challenge will be water security. In addition to the effects of global warming, water availability is directly affected by increasing demand for water from industry, agriculture, urbanization and tourism. This escalates global demand for renewable energy, which is strongly water-dependent, saline intrusions and the pollution of surface- and groundwater. There are multiple risks associated with water scarcity. To name but a few: loss of livelihood due to increasing water variability, modification of river streams and morphology, transmission of pollution to the entire water system (including the ocean and seas).

2.2 *Climate Change*

While the ocean is essential to regulate the Earth's climate, human-induced climate change is altering the state of the ocean and waters and the critical functions they fulfil. On the other hand, the marine ecosystems and the blue economy play a role in carbon emissions as well as in their sequestration that is under-estimated and under-valued.

The cumulative impacts of climate change

Climate change concerns everybody. During the 20th century, the global mean **sea level** rose by about 15 cm³⁵. Sea level is currently rising more than twice as fast and is projected to further accelerate, reaching up to 1.10 meter in 2100, if emissions continue to rise throughout the century.

³⁴ Pastor et al. 2014. "Accounting for environmental flow requirements in global water assessments", in *Hydrology and Earth System Sciences*, Vol. 18: pp., 5041–5059.

³⁵ IPCC 2019. Ibid.

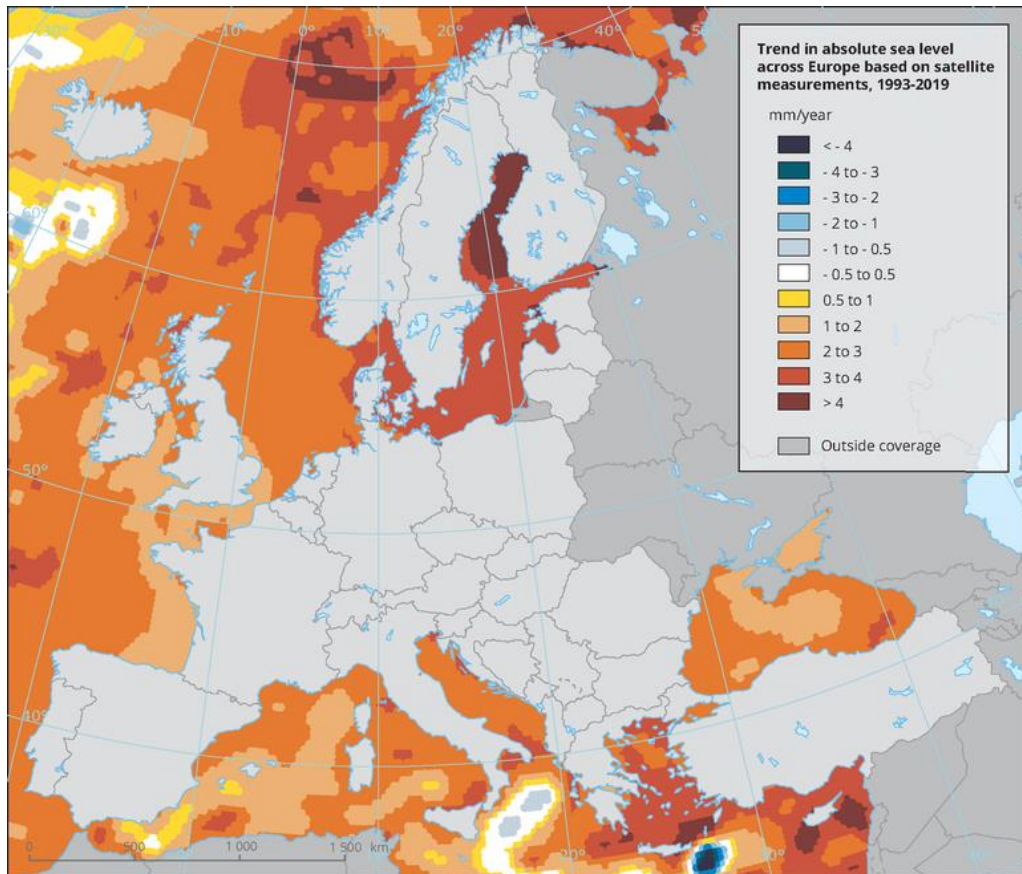


Figure 5. Trend in absolute sea level across Europe (based on satellite measurements - 1993-2019 - change in mm/year)³⁶

Extreme sea level events and floods will occur more frequently and may be further exacerbated by **extreme weather events and coastal erosion**, increasingly threatening Europe's coastal communities³⁷. They could increase storms in Europe and change rainfall patterns³⁸. An increase in the occurrence and frequency of floods, avalanches, landslides, and ground destabilization will pose an increased risk for infrastructure, cultural, tourism, and recreational assets³⁹.

Increased carbon dioxide emissions and their subsequent absorption by the ocean and waters lead to their increasing **acidification**. Since the beginning of the Industrial Revolution, the acidity of the ocean has increased by 30 percent, witnessing a drop of 0.1 pH units. Over the next hundred years, ocean pH is anticipated to decline by a further 0.07 to 0.31 pH units. Ocean acidification particularly decreases plankton weight, dissolves calcareous shells and impacts

³⁶ <https://www.eea.europa.eu/data-and-maps/figures/trend-in-absolute-sea-level>

³⁷ EEA 2019. *Global and European sea-level rise*.

³⁸ IPCC 2019. *Ibid.*

³⁹ IPCC 2019. *Ibid.*

corals. In addition, both acidification and warming affect the availability and toxicity of several chemicals, leading to cumulative effects of multiple stressors on organisms and ecosystems.

Warming and acidification of marine waters result in **cascade effects on marine ecosystems**, bringing them to tipping points. The decrease in plankton and corals has repercussions on the entire food chain of fishes and marine mammals, affecting global food production and, ultimately, security. As species are moving to higher latitudes and to deeper locations, global fisheries biomass is projected to decrease, and fishing communities will be affected by changing global catch potential. A decrease in the productivity of marine ecosystems in the North Atlantic can be expected.

These changes are projected to further increase. According to the IPCC⁴⁰, the ocean is projected to change significantly over the course of the 21st century, with increased temperatures and more frequent marine extreme weather, further acidification and destruction of coral reefs, changing currents, oxygen decline, greater stratification and altered net primary production.

Climate change also affects freshwaters. It disturbs the physics, chemistry and biology of lakes and rivers and eutrophication causes water bodies to emit more methane. The temperature of rivers and lakes rises, which makes them hostile to cold-water fish, causing the formation of dead zones. Due to heavy rainfall, the flow of rivers rapidly and frequently changes from the lowest to the highest levels, which disturbs the comfort of plant life and animal reproduction⁴¹. Only the restoration of biological equilibrium can reverse this trend.

We are currently witnessing a trend towards lower precipitation levels in the Mediterranean and more frequent droughts in many other European regions. The years 2018, 2019 and 2020 all saw exceptionally long dry periods in regions that had, until now, only rarely experienced such phenomena. This, along with more frequent heavy rainfall events, poses new **challenges to fresh water management with competition for available water resources** increasing. Drinking water supply needs to be ensured in the long-term.

Water regimes are also projected to change drastically. Large areas may become unsuitable for human life because of water scarcity, while in other areas floods will become more severe with serious consequences. In addition, the cryosphere (the part of the earth covered by ice) is disappearing. Glaciers are melting, with considerable impacts on the land use of water resources (such hydropower, agriculture, drinking water). The extent of the Arctic sea ice is declining. In 2019, Greenland's ice was melting at the rate of 1 million tons per minute, thus constituting the highest loss over centuries or even millennia⁴². If all the ice in Greenland were to melt, global mean sea level would rise by over 7 meters, while total ice melting in Antarctica would raise the global mean sea by an additional 58 meters.

⁴⁰ IPCC, 2019. Ibid.

⁴¹ Havens, K. Jeppesen, E. 2018. *Ecological Responses of Lakes to Climate Change*. Water Vol 10(7): p. 917.

⁴² Sasgen, I. et al. 2020. "Return to rapid ice loss in Greenland and record loss in 2019 detected by the GRACE-FO satellites". *Communications Earth & Environment*, 1-8.

These changes are also affecting ocean circulation. The Gulf Stream, which is largely contributing to Europe's mild climate, to sufficient precipitation for reliable agriculture and to high yields of Atlantic fisheries⁴³, is projected to weaken over the 21st century, with significant consequences for Europe and the world. Any substantial weakening is projected to cause, amongst other things, a decrease in marine productivity in the North Atlantic, more storms and higher rainfall in Northern Europe but less precipitation in Southern Europe as well as further increases in sea level rise in Europe⁴⁴.

The ocean can contribute to decarbonisation

Despite the alarming impacts of climate change, our ocean and waters can play a tremendously important role in **mitigating and adapting to climate change**. Coastal ecosystems – salt marshlands, mangroves, seagrass meadows, kelp forests - store carbon over centuries and in a larger area than forests on land. They remove carbon dioxide from the atmosphere, making them significant net carbon sinks⁴⁵. Marine fauna also contributes by accumulating carbon as biomass⁴⁶. Whales have a particularly high potential at carbon cycling within the marine domain, with each great whale sequestering on average 33 tons of CO₂⁴⁷.

In addition to their carbon sequestration capacity, vegetated marine ecosystems provide coastal protection against sea level rise and mitigate flooding, they regulate water quality, provide critical habitat for many marine species, enhance biodiversity and resilience, and provide additional revenues through tourism and recreational activities. However, if ecosystems are degraded or damaged, the carbon stored in the soil is released, resulting in CO₂ emissions that contribute to climate change. Between 20 and 50 percent of global blue carbon ecosystems have already been converted or degraded⁴⁸.

Human activities at sea are not exempt from reassessing their contribution to CO₂ emission. However, their role is until now largely under-estimated, both in terms of their negative as well as potential positive impacts. Moreover, the potential for development of blue activities is often identified in disconnection from other systemic challenges.

The continuing use of **fossil fuels** is the single greatest challenge in tackling climate change. As in land transport, **maritime propulsion** systems can turn to low-carbon or carbon-free models. Battery-powered ferries are already in operation. Electric fishing boats are on the drawing board. For intercontinental trade or longer fishing trips alternative fuels are being examined – liquid hydrogen, biofuel, ammonium. The challenge is to turn these experimental, concept-stage carbon-neutral propulsion systems into an industrial scale

⁴³ Latif, M. et al. 2017. *The Future of the Gulf Stream Circulation*. DKK and KDM: Berlin.

⁴⁴ IPCC 2019. Ibid.

⁴⁵ IUCN 2017. *Issues Brief – Blue Carbon*
https://www.iucn.org/sites/dev/files/blue_carbon_issues_brief.pdf

⁴⁶ Hoegh-Guldberg, O., et al. 2019. "The Ocean as a Solution to Climate Change: Five Opportunities for Action." Report. Washington, DC: World Resources Institute.

⁴⁷ Chami, R. et al. 2019. "Nature's Solution to Climate Change", Finance & Development Vol 56(4): pp. 34-38.

⁴⁸ Hoegh-Guldberg, O. et al 2019. Ibid.

deployment for the entire European fleet. Little has been achieved so far on such an issue.

More broadly, the long-term energy plan for the EU envisages fossil fuels being phased out. This includes **oil and gas extracted from the ocean**. The European Investment Bank has announced that it will align its financing activity with the goals of the Paris Agreement by the end of 2020, and it will stop financing fossil fuel extraction. Ireland has also decided to stop granting oil exploration licences. The transition to the phasing out of fossil fuel needs to accelerate to meet the climate change policy goal.

By contrast, **offshore renewable energy** can make a clear positive contribution to decarbonisation. Member States have already pledged to quadruple offshore renewable energy capacity by 2030. By 2050, when the EU aims to be carbon-neutral and when its electricity consumption will have doubled to replace fossil fuel in transport and industry, about a quarter could be generated offshore. Based on current trends, offshore wind⁴⁹ is forecast to be the most prominent renewable offshore energy, with tidal and wave energy predicted to have a smaller contribution in the EU, until the technology matures⁵⁰ and installations are scaled up. Despite this promising outlook, a lack of adequate technologies, industrial production capacities, connections to the existing energy system and maritime space hinders the large-scale development of marine renewable energies in Europe.

The ocean can also contribute to the development of an innovative sector, **marine biotechnology**. Europe has an abundant source of marine biotech raw materials and is at the forefront of ocean sciences. It is therefore already endowed with the two key commodities: marine biota with a rich DNA able to survive in extreme environments and biotechnologists with backgrounds in ocean sciences and marine biology. Blue biotech is already in use in pharmaceuticals and nutraceuticals, food and feed, textiles, polymers, bioplastics and other biomaterials, biofuels and bioremediation. Yet, its development remains sub-optimal due to a lack of structured support to innovation and venture capital at both national and European level.

2.3 Lack of understanding, connection and investment

Oceans and waters are taken for granted. Despite their fundamental importance to humanity's existence, public and political attention has not corresponded to the urgency to address the above-mentioned pressures. Historically, there has

⁴⁹ According to Wind Europe <https://windeurope.org/about-wind/statistics/offshore/>, Europe has a total installed offshore wind capacity of 22,072 MW from 5,047 grid-connected wind turbines across 12 countries in 2019. EU member states have 12 GW installed power which is equivalent to 12 PWR nuclear reactors. However, wind energy production never reaches the installed power since the source of energy (wind) is not uniform.

⁵⁰ See: Magagna, D., Shortall, R., Telsnig, T., Uihlein, A. and Vazquez Hernandez, C., Supply chain of renewable energy technologies in Europe - An analysis for wind, geothermal and ocean energy, EUR 28831 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-74281-1, doi:10.2760/271949, JRC108106; Collombet, R. 2020. Ocean Energy - Key trends and statistics 2019, Ocean Energy Europe March 2020 (<https://www.oceanenergy-europe.eu/>); Magagna, D. and A. Uihlein, A. 2015 Ocean energy development in Europe: Current status and future perspectives, International Journal of Marine Energy 11 (2015) pp. 84–104.

been a significant political and financial underinvestment in the public goods that this eroding natural capital provides.

"Out of sight, out of mind"

The general public and our ocean and waters are separated by an emotional gap. History of mankind is linked to the sea, in particular European history – from the *Mare Nostrum* to the Hanseatic League, from the discoveries of the new continents to exploration of the deep seas. Europe is endowed with a vast historical and cultural heritage that leaves its traces in our coastal cities and ports, libraries, museums and aquaria. Yet, the connection of European citizens with the ocean, seas and waterways is complex and diverse. Many Europeans are unaware of the importance of the ocean and waters for their daily lives. A key challenge is the vastness of the ocean: the seas and the aquatic system are often 'out of sight, out of mind'.

This disconnection from aquatic environments constitutes a **barrier to catalysing the scale of change** required to address the challenges, whereas most of them are very sensitive policy issues: ocean litter affects mass tourism in Mediterranean countries, soil sealing as a result of urban sprawl patterns leads to higher flood risk and vulnerability to sea-level rise as well as dampened replenishment by precipitation of groundwater, chemical and nutrient pollution from agriculture leads to the degradation of coastal wetlands and drinking water, spilling of contaminants in rivers and seas pollutes bathing waters, etc. The scale of the challenges at hand requires a fundamental shift in society's functioning and the relationship we have with the aquatic world.

A key challenge to the health of our ocean and waters is to create an "ocean literate" society, where all segments of society – including political and business leaderships - understand the value of oceans and waters for our well-being and the impacts of our economic model on the natural capital they represent. This requires building on this living common heritage, turning better information into knowledge, and knowledge into public awareness and passion about the threats and potential solutions that the ocean and rivers offer. Only this can lead to large-scale societal mobilisation and political and economic courage to restore, protect and enhance the essential goods and services they provide.

Yet, the past year has witnessed impressive behavioural changes. Citizens and economic actors have expressed a strong wish to lead different lives, where they can explore wellbeing through ecosystem benefits. An increasing number of citizens engage in beach clean-up initiatives. The scene is set for society to answer to the challenge as positively as it can. Citizens and industry are up for it, if we can present new choices to them and stimulate and support them in exploring new ways of doing things and scaling them up. The recognition of life below water as a UN Sustainable Development Goal (SDG 14) in its own right and the decision of the UN General Assembly to launch a UN Decade of Ocean Science for Sustainable Development 2021-2030⁵¹, for example, reflect an increasing public attention. They provide an opportunity for ocean literacy initiatives of various scales that will allow society to strengthen its interest in the

⁵¹ United Nations General Assembly. 2017. *Resolution A/RES/72/73, Part XI of the Omnibus Resolution for Ocean and the law of the sea.*

intrinsic value of ocean and waters, the challenges they face and the opportunities they offer.

No measurement, no prediction, no management

Since 30 years, Europe has developed a world-leading position in ocean observation from space. Thanks to the Copernicus programme⁵², EU public ocean forecasting and ocean climate services have been developed, in addition to meteorology, to increase our understanding of the oceans. However, while the effects of pollution, human activities and climate change are documented and observable, significant **gaps in our understanding and knowledge** of the hydrosphere and the challenges it faces remain. For instance, of the millions of tons of plastic that are estimated to be in the ocean, we can only account for around one percent as no global monitoring of marine litter exists⁵³. Moreover, the full extent of ecosystem services our ocean and waters provide is not yet fully known and many potential solutions are yet to be discovered. Better accuracy is necessary in terms of spatial occurrence, frequency and intensity predictions of extreme events, sea level rise. More generally, ocean forecasts and climate projections and the interface between oceans, inland waters and land need to be connected, and this will require time-series and higher resolution observations and models.

However, marine information in the EU remains highly fragmented. Data is typically collected and managed for specific and limited purposes by governmental agencies, researchers and businesses with restricted visibility, accessibility and hence coordination and cooperation. Despite the efforts, for instance through the Copernicus Marine Service, EMODnet and the Blue Cloud⁵⁴, much more needs to be done in Europe to increase significantly the deployment of observatories (at sea and inland), federate data infrastructures, make open data the new norm and provide tools and services to transform data into knowledge.

Similarly, existing datasets on freshwater are still insufficient. Sufficient and reliable data on consumer or agricultural freshwater use and on groundwater, in particular, is lacking. In recent years, there has been growing concern regarding micro pollutants. Yet, they lack a common general description and there is a dire

⁵² COM(2018) 447 final 2018/0236 (COD) , Proposal for a Regulation of the European Parliament and of the Council establishing the Space Programme of the Union and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013, (EU) No 377/2014 and Decision 541/2014/EU, {SWD(2018) 327 final} - {SWD(2018) 328 final}

⁵³ Van Sebille, E. et al. 2015. "A global inventory of small floating plastic debris", *Environmental Research Letters*, Vol. 10(12).

⁵⁴ The Copernicus Marine Service has been designed to respond to issues emerging in the environmental, business and scientific sectors. Using information from both satellite and in situ observations, it provides state-of-the-art analyses and forecasts daily, which offer an unprecedented capability to observe, understand and anticipate marine environment events (<https://marine.copernicus.eu>). The European Marine Observation and Data Network (EMODnet) is a network of organisations supported by the EU's integrated maritime policy. These organisations work together to observe the sea, process the data according to international standards and make that information freely available as interoperable data layers and data products (<https://www.emodnet.eu>). Blue-Cloud is a European H2020 project with the overarching aim to provide a virtual environment with open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines (<https://www.blue-cloud.org>).

need for more research on this topic to provide effective protection of water resources.

Closing these knowledge and measurement gaps will be key to better protect, manage and harness our ocean and waters and to unlock a whole range of opportunities for citizens, policymakers and investors.

Political and financial underinvestment

Until now, this insufficient understanding of the public goods and services that the ocean and waters provide, and the lack of dialogue between science, citizens and policy makers has resulted in **insufficient political action** to protect and manage sustainably the ocean and waters. At worst, political courage has been lacking, at best, there has been only reactive and limited action, unplanned and directed towards partial impact remediation. But the readiness of society to embrace change is growing. **Public discourse and strategy should rather, now and in the future, frame the situation as an ecological and climate crisis** that needs to be addressed with planned and systemic investment. The aim is to allow for a proactive, pre-emptive and thoroughly planned strategic protection and management of the natural capital of ocean and water ecosystems and resources, capable of producing a high positive return, and recognising the positive systemic effect that the ocean can deliver to combat climate change.

As a result of this disconnection, investments in the **blue economy** are squelched by the, often dire, needs of the wider economy and redirected to other competing priorities. Available studies⁵⁵ on the support of investment towards the sustainable development of the blue economy have demonstrated that in particular small and medium-sized enterprises (SMEs) face difficulties in financing their activities because of higher levels of information asymmetry between them and investors, the lack of certain types of assets to pledge as collateral for loans, and investors' preference for larger financing deals due to economies of scale.

Similarly, relevant financing for the necessary **research and innovation** investment in the EU to also underpin sustainable ocean and waters action is lagging behind. In general, the approach has been project-based and bottom-up, and not starting from a perspective that strategic and systemic investment in the natural capital is necessary to keep and to improve the public goods and services. Research activities of the Member States are more fragmented and competing than joined up. This situation does not create the conditions for financial institutions and businesses to target investment in climate mitigation, for investment in future drugs and vaccines, and for identifying cost-effective carbon sequestration opportunities at sea.

Upskilling and reskilling is a necessary parallel investment. The current political context provides additional incentives for the creation of new blue **skills and jobs**. The changes in the skills landscape all point towards utilising the current ecological imperatives for the upgrading of blue skills. Renewable offshore energy production, blue eco-tourism, clean maritime transport, blue biotechnology and the development of sustainable aquaculture increasingly rely on science, technology, engineering and mathematics, digital, green and blue skills.

⁵⁵ Source: <https://webgate.ec.europa.eu/maritimeforum/en/node/4226>

Investing in sustainable ocean action during these times of unprecedented economic emergency needs to be urgently reassessed. There is an excellent **opportunity to contribute to the recovery** of the whole economy that must not be overlooked. The European Green Deal and the digital transformation proclaimed at European level call for kick-starting the economy through targeted capital investment, while being at the same time conducive to effective ocean action. Using this window of opportunity to achieve the required transitions to a healthy planet within the next decade will be key for protecting and restoring these major and fundamental ecosystems.

2.4 *Inadequate governance*

The ocean and waters and their resources are governed by a fragmented, partial and often sectoral framework of international, European, national and local institutions. This poses a challenge for their effective and sustainable management.

At **European level**, one of the most comprehensive policy frameworks in the world has been put in place with the ambition to set up a holistic, ecosystem-based approach to the protection of the freshwater and marine environment. The Water Framework Directive (WFD), supported by its "sister" directives⁵⁶, and the Marine Strategy Framework Directive⁵⁷ (MSFD) set the ambition to achieve "Good Environmental Status". However, the persisting **multisector and multilevel segmentation** of the instruments, policy frameworks and institutional arrangements weakens the overall European governance framework. Several legislations with an environment protection objective (Birds, Habitats, REACH, Nitrates) directly impact the water cycle, while several sectoral policies with a strong European dimension regulate directly maritime sectors (Common Fisheries Policy, transport and ports) or sectors that strongly impact inland and marine waters (Common Agricultural Policy). However, despite efforts to design an Integrated Maritime Policy – in particular its Blue Growth dimension and regional Sea basins strategies - there is a lack of an overall framework for all these interventions which would connect them to marine protection objectives from a water cycle approach.

In spatial terms, the Maritime Spatial Planning Directive⁵⁸ aims not only to enhance compatibility and ecosystem-based management of maritime activities in each country but also to promote transboundary cooperation. However, competence for spatial planning, managing the marine, maritime and water issues and steering local economic development are with Member States. National governance systems are often complex and often deal with maritime and

⁵⁶ Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (OJ L 135, 30.5.1991, p. 40-52), Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (OJ L 372, 27.12.2006, p. 19-31.), Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption (OJ L 330, 5.12.1998, p. 32-54.), Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (OJ L 64, 4.3.2006, p. 37-51).

⁵⁷ Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (OJ L 164, 25.6.2008, p. 19-40).

⁵⁸ Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (OJ L 257, 28.8.2014, p. 135-145).

water issues at different levels of governance. Hence, the same activities can be dealt with at local, regional, national or other scale in each country, causing further segmentation.

Moreover, surveillance and control of activities at sea also belong to a complex mix of bodies and governance structures, primarily under national competence. Despite a positive trend towards a better exchange of information and cooperation or coordination among national authorities under the umbrella of EU agencies and the EU Maritime security strategy, maritime surveillance remains fragmented at EU level, both across various levels of governance and sector specific approaches (maritime safety, fisheries, customs, border control, etc.).

Overall, this results in imbalances in the attention given to various issues, economic and administrative burden and a weak capacity to assess the efficiency of policy tools. The challenges in the decade to come will be to build on these policies and agreements and on scientific knowledge to advance coherently the sustainability of marine and maritime activities, to develop tailor-made strategies at territorial level, to respond to the impacts of climate change and to conserve and restore aquatic ecosystems as a whole.

At global level, a similar **institutional fragmentation** can be observed, as underlined by the Global Ocean Commission⁵⁹. The UN Convention on the Law of the Sea (UNCLOS) provides the overall legal framework. It comprises a number of provisions, for instance, on the management and control of seabed minerals in international waters for which the International Seabed Authority was established. It is also complemented by an important body of agreements on fisheries management, under the supervision of the Food and Agriculture Organisation (FAO). In addition, there are other sectoral institutions, such as the International Maritime Organisation, which deals with maritime transport.

There are also different conventions dealing with environment protection objectives, such as the Convention on Biodiversity (with the "Aichi" targets⁶⁰) or the International Convention for the Regulation of Whaling. A legally binding instrument for management of biodiversity and biological resources beyond national jurisdiction (BBNJ), including for the establishment of protected areas, is currently under negotiation⁶¹.

Moreover, the international community has agreed on the UN Agenda 2030 setting Sustainable Development Goals⁶² (SDG), where SDG 6 establishes targets for water and sanitation and SDG 14 for the marine environment. However, there are many other goals implicitly related to the health of the ocean and waters such as SDG 12 on responsible production and consumption or SDG 13 on climate action. In parallel, there are a number of initiatives to support knowledge, like the UN Decade of Ocean Science for Sustainable Development (2021-2030) with contributions from the "World Ocean Assessment I"⁶³ on the state of the ocean.

⁵⁹ Source: https://issuu.com/missionocean/docs/goc_full_report

⁶⁰ CBD 2010. Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity targets. <https://www.cbd.int/doc/decisions/cop-10/cop-10-dec-02-en.pdf>

⁶¹ Source: <https://www.un.org/bbnj/>

⁶² United Nations, 2015. Transforming our World: The 2030 Agenda for Sustainable Development (https://sustainabledevelopment.un.org/content/documents/21252030_percent20Agenda_percent20for_percent20Sustainable_percent20Development_percent20web.pdf)

⁶³ Source: <https://www.un.org/regularprocess/content/first-world-ocean-assessment>

At regional level, Regional Sea Conventions⁶⁴ aim to tackle environmental issues and there are sectoral organisations such as the Regional Fisheries Management Organisations from the FAO, related to catch and fishing efforts restrictions.

For freshwater, 70 percent of all river basins in the world are transboundary, i.e. shared by two or more countries. Yet, traditionally each country has managed their water resources independently. This has caused a lot of tension between upstream and downstream countries. Increasing water consumption for agriculture, industry and drinking water together with decreasing availability of water because of climate change provides a high risk of humanitarian crises in many parts of the world. This calls for good governance, i.e. strong action for joint, integrated and sustainable management of water resources. The UNECE Transboundary Water Convention, which became global five years ago, provides a good basis for this, but many countries need support for establishing well-functioning joint management.

This weak international governance, in which the EU has nevertheless traditionally played a leading role, results in inconsistencies, overlaps and gaps between jurisdictions that unsustainable and illegal practices can exploit, as well as weak transparency, accountability and compliance of the members of the organisations and parties to the agreements. Ultimately, this leads to a poor – almost non-existent – protection of marine resources in areas beyond national jurisdiction.

⁶⁴ Around Europe we have OSPAR for the North East Atlantic, HELCOM for the Baltic Sea, the Barcelona Convention for the Mediterranean and the Bucharest Convention for the Black Sea.

3 Mission Starfish 2030: Restore Our Ocean and Waters

As shown, unsustainable human activities and climate change, reinforced by lacking understanding and inadequate governance, result in systemic, interdependent and cumulative pressures that severely threaten the health of our ocean, seas, coastal and inland waters. To preserve these public goods and replenish their value, we must look at the water cycle as a whole and systematically tackle the identified challenges at source. To this end, this Mission proposes a holistic and coherent 2030 vision to address the various interacting and cumulative threats to our ocean and waters. Its overall goal is **to restore our ocean and waters by 2030**.

More concretely, inspired by the shape of the **starfish**, the Mission will address the four interdependent challenges – unsustainable footprint, climate change, lack of understanding, connection and investment, inadequate governance - by proposing **five overarching objectives for 2030**:

- Filling the knowledge and emotional gap
- Regenerating marine and water ecosystems
- Zero pollution
- Decarbonising our waters, ocean, and seas and waters
- Revamping governance

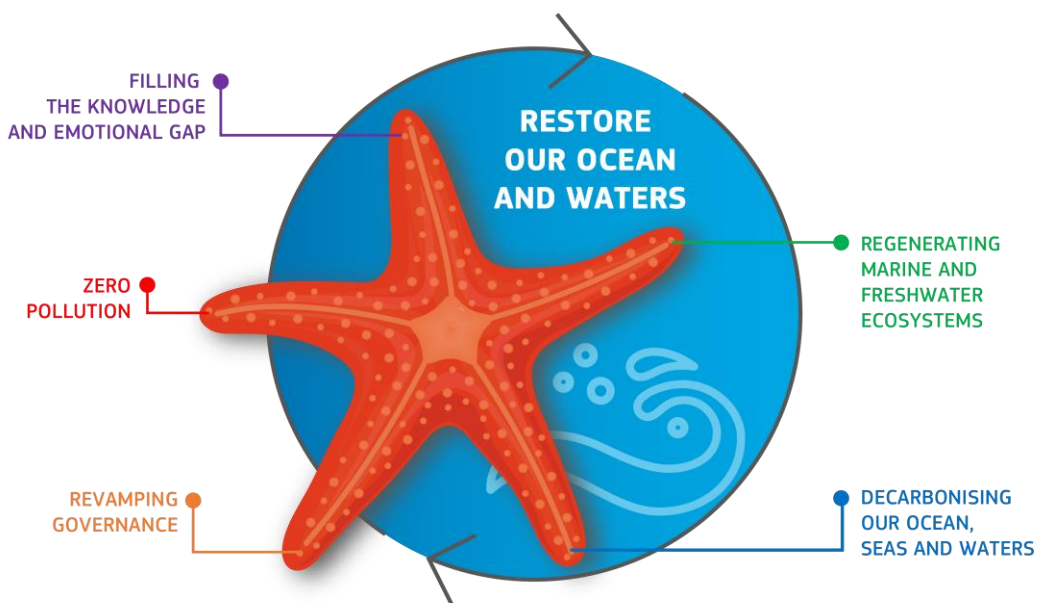


Figure 6. Mission Starfish 2030 ©European Union, 2020

A child was walking along the beach after a storm and found it covered in starfish. Upset at the sight, the child started putting them back into the water one by one. An old man came up and said: "What are you doing? There are thousands of starfish — way too many for you to make a difference." The child looked at the

old man, picked up a starfish, put it back into the ocean and said, "It made a difference to that one" (adapted from The Star Thrower, by Loren Eiseley).

The Apollo missions shot for the moon; this Mission reaches for the stars – the starfish at our feet. Instead of developing space technology and exploring the Moon in the national interest, the Mission Starfish 2030 sets out an ambitious, holistic vision to regenerate our ocean and waters for the benefit of all life on Earth.

The starfish's natural habitat is our home. To care for the health of our ocean and waters is fundamental to the health of our planet, our well-being and prosperity. But the starfish, like all life on Earth, is threatened by our lifestyle. To save the starfish, and ultimately all life on our blue planet, we can no longer take its existence for granted, but must engage in a profound, systemic change towards sustainability and resilience.

The starfish is a symbol of life under water. It is an extraordinary creature. For example, its decentralised nervous system enables the regeneration of lost arms. Likewise, the Mission Starfish 2030 will enable regeneration of marine and water ecosystems via five interdependent objectives.

These five objectives are mutually supportive. The core is to regenerate ecosystems by directly protecting and revitalising them. This already major task will not be complete unless pollution is halted. But as climate change is intimately linked to the health of the ocean, the transition to climate neutrality by decarbonising the blue economy is also essential. Such transformation must be enabled by a revamped governance system that is fit for and up to the challenge. Finally, such ambition of environmental, economic and social change must be supported by society and science: the knowledge and emotional gap must be filled as a cross-cutting supporting action.

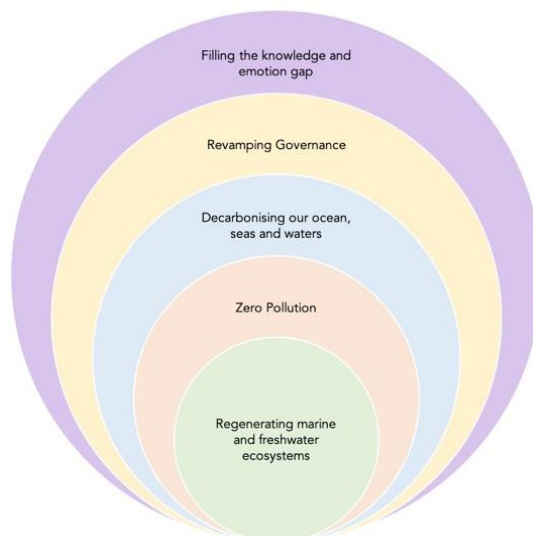


Figure 7. Five mutually supportive objectives

Taken together, the five objectives of Mission Starfish 2030 will enable regeneration of marine and water ecosystems. But defining such objectives is not sufficient, they need to rely on more specific components that will trigger concrete action. Therefore, for each of the five objectives, a set of ambitious, concrete and measurable targets has been defined. They address the actors, activities, tools and systems that all need to be called upon to reach each objective. These **17 targets** are considered to be the indispensable components of a holistic approach to systemic change.

Objective	Target	
<i>Filling the knowledge and emotional gap</i>	1	Each European is a citizen of our ocean and waters
	2	Marine and freshwater observation is streamlined and accessible to all via a digital twin of the ocean and all waters
<i>Regenerating marine and water ecosystems</i>	3	30 percent of EU waters are highly to fully protected
	4	Active regeneration of 20 percent of degraded habitats
	5	Renaturalise rivers and waters
	6	End overfishing
<i>Zero pollution</i>	7	Zero plastic litter generation
	8	Eutrophication of European seas and waters is halted
	9	Zero spill
	10	Underwater noise is regulated and reduced
<i>Decarbonising our ocean, seas and waters</i>	11	Climate-neutral waterborne transport
	12	Support the energy transition through renewable, low-impact ocean energy
	13	Zero-carbon aquaculture
	14	A thriving blue biotech
	15	Climate-neutral blue tourism
<i>Revamping governance</i>	16	An integrated and participatory EU system of ocean and water governance
	17	EU leadership for effective global ocean governance

Table 1. Five objectives, 17 targets

Unless otherwise stated, the baseline for the proposed targets is the year 2018 or 2019, whichever is the last year of available data.

3.1 Filling the knowledge and emotional gaps

Reaching the ambitious targets set for this Mission will not be possible without the full support of people and science. It is fundamental that every citizen in Europe becomes co-owner but also co-responsible for the success of the Mission. Empowering citizens to better value and safeguard their ocean and waters leading them to “love the unknown” and to discover the full extent of the interconnection between human and marine life and water resources is a key enabling intervention to underpin major economic and social transformations.

Our aim is therefore that **every European citizen becomes a citizen of our ocean and waters**. This, in itself, is an objective of the Mission: engaging, inspiring and motivating citizens to fully apprehend our ocean and waters as a common good. In other words, creating a community of citizens who value the ocean and waters as a common good and a natural capital to preserve, who want to engage in the Mission’s goals to know, restore and protect the ocean and waters, as well as to enjoy them with sobriety and care for them collectively.

All channels should be used: education of all generations, citizen voluntary engagement such as beach clean-up initiatives, citizen science, and ocean-literacy initiatives for the public at large. This will be embodied in a European regeneration voluntary corps, a pan-European ocean literacy coalition of civil society organisations, schools, museums, aquaria, cultural centres and events, a pan-European “blue education” programme and a pan-European strategy for marine science.

We also need to prepare the **blue economy workforce** to face a challenging economic transformation. New emerging sectors will create new types of jobs and will require new qualifications. Tomorrow’s blue economy will have to attract talented individuals with cutting-edge professional skills who will increasingly need to understand, interact and create at a cross-disciplinary and cross-sectoral level. Therefore, we need to intensify mobility between academia, authorities and industry and to harmonise education programmes, adapted to emerging competence needs.

There will be major needs to support people working in the blue economy sectors most affected by the Covid-19 crisis, such as coastal tourism. Member States and regions most impacted should prioritise access to the EU-recovery package for this workforce. A dedicated training and upskilling effort supported by the EU should help a new gender-balanced blue workforce sail through the challenge.

Target 1: Each European is a citizen of our ocean and waters

By 2030	Checkpoints for 2025
<ul style="list-style-type: none">• Literacy and knowledge about the water system are compulsory elements in all science curricula in primary and secondary schools throughout the EU• 50 percent of Europeans have participated in events organised by	<ul style="list-style-type: none">• A pan-European education programme on ocean and waters is implemented• A pan-European ocean literacy coalition of civil society organisations, youth organisations and schools, museums, aquaria and cultural centres and events is created

<p>the pan-European ocean literacy coalition (EU4Ocean)</p> <ul style="list-style-type: none"> • At least 50 percent of the European blue workforce has been upskilled or re-skilled 	<ul style="list-style-type: none"> • A European regeneration voluntary corps has been created and have branches in all European countries • 20 percent of data collections comes from citizen's science initiatives • European academic institutions coordinate and implement a coherent Europe-wide marine science curriculum and strategy for marine science • The Blue ERASMUS programme enables students and apprentices to broaden their knowledge on ocean and waters from an interdisciplinary social and natural science perspective throughout Europe • Member States most affected by the Covid-19 crisis have up-skilled and re-skilled 25 percent of their blue economy workforce with the support of the EU
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Piloting deep transformation also requires bridging the major gaps in science, observation and forecasting capacity that still exist in the EU and globally. Not only should we aim to generate additional knowledge about the ocean as an ecosystem, but we need to underpin and support regeneration policies through better and fit for purpose data systems. Today's technologies already allow for that, tomorrow they will be even more powerful and accurate and should be used to the full.

Therefore, our aim should be to **fully map, sequence, observe and predict our ocean, seas and rivers**. The goal is to build on the existing forecast and climate modelling infrastructures and services (including Copernicus services for marine, climate, coastal, emergency, inland waters, etc.) and pool together all available observation data, first at EU-level then globally, into an open-source, easily accessible and understandable interface and matching application and an interactive platform: a Digital Twin of the Ocean. Only such infrastructure will allow to develop trusted and fit for purpose science-based deliverables (observation system, modelling capacity, maps) that can be used as services to underpin the different proposed actions of this Mission. As an interactive platform, it will also enable citizens, economic actors and policy makers to communicate with scientists and make proposals for action.

Such services, used to develop tailored applications, can help track pollution, climate change and impacts of human activities in real-time. They can be used by all economic actors, public authorities and civil society to monitor, observe and enable actions on pollution, climate areas of priority, maritime spatial planning, safe navigation and support civil society's participation in ocean and water governance and policy-making. They can serve as risk-management tools for the financial and insurance sectors to assess sustainability credentials of investments. In addition, sequencing the DNA of our ocean and waters, as a common public good, will offer immense opportunities to discover new molecules and biotechnologies for the wellbeing and health of European citizens. In other

words, closing these knowledge gaps is essential to underpin the major economic transformations that regenerating our ocean and waters is calling for.

Target 2: Marine and freshwater observation is streamlined and accessible to all via a digital twin of the ocean and all waters

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • Global digital twin of all oceans and waters is operational • Global marine and freshwater observation is streamlined: all data collected is pooled centrally and made accessible to all • Global high-resolution ocean forecasting and regional ocean climate services are operational to support climate change adaptation at coastal scale • The European seabed is fully and coherently mapped in high-resolution • 50 percent of DNA of life in our ocean and waters is fully sequenced and publicly available 	<ul style="list-style-type: none"> • European digital twin pilot of European oceans and waters is operational • European marine and freshwater observation is streamlined: all data collected by EU Member States is pooled centrally and made accessible to all. • The Copernicus programme deploys coastal-scale ocean forecasting and climate services • The North Atlantic Seabed is fully and coherently mapped in high-resolution • 20 percent of DNA of life in our ocean and waters is fully sequenced and publicly available

Supporting action plan

- Replenishing the emotional deficit of European citizens with ocean and waters calls for **initiatives in all European countries**, supported by the EU, that address the youth as a priority. Youth engagement could be supported in many different ways and Member States, local actors and youth associations should be invited and supported to develop their own home-grown projects. The EU would in any event lead the way by launching a European blue regeneration voluntary corps, with the specific purpose to take part in the Blue Parks programme (see below) and be ocean/water ambassadors across the EU and their countries.
- **Education** is another major channel to connect with ocean and water. The EU should invite Member States to exchange experience and ideas for the adaptation of primary, secondary and university curricula and aim for an action programme resulting in knowledge about the oceans and the water system becoming a compulsory element in all science curricula. This would be completed by the creation of a pan-European programme for apprentices as well as by a Blue ERASMUS-like programme for university students. These programmes should focus on Mission specific diploma, masters and PhD programmes.
- **Citizen’s science** with larger public engagement will help gather empirical data and foster public participation and cooperation in scientific endeavours. Promoting exchanges between society and science and broadening access to knowledge, citizen science will help build confidence and provides learning

experiences for participants as well as draw on citizens' knowledge to develop the solutions for regenerating the ocean and waters.

- Generating a new **blue workforce** will require a complete review of training and education provision for people of all ages, including a diversified skill and competences framework focusing on the blue jobs of the future and on preservation and protection of marine biodiversity, ocean and human health and specific attention to lifelong gender-balanced learning opportunities.
- All this can only be achieved through the **active cooperation with and co-ownership** by all public authorities involved in the Mission's implementation, notably by:
 - Bringing together new and existing European marine universities and departments, as well as scientific units and organisations dealing with freshwater, to coordinate, support and implement harmonised goals for marine and water science.
 - Enhancing at local level cooperation among universities, vocational education and training centres, chambers of commerce and innovative SMEs to develop new skills and competence frameworks. This will increase employment opportunities for local and regional communities and alleviate risks of social exclusion and brain drain.
 - Working in all Member States with existing networks of science museums, aquaria, and cultural centres in general to add a 'blue dimension' to their activities.
 - Collaboration between scientists and filmmakers and artists to create enduring campaigns to raise awareness about ocean and waters.
 - Using local cultural traditions and art as a means to build local visions of new economies, social contracts and community identities and to inspire and empower people and local communities.
 - Continuous feed of the European and local press and information media with popular science articles promoting public awareness for the ocean and waters.
- A **European Strategy for Marine Science** should aim to overcome the current fragmentation of studies and research, avoid duplication, enable transitioning science and innovation into sustained services, save costs and build an efficient way to make European countries and researchers work towards a common result: make the EU the world leader in ocean and waters scientific knowledge and data. This European marine research strategy would be the foundation for other programmes to be successful.
- **Streamlining** existing data, models and services, as offered by the Copernicus Marine Service and EMODnet, should result in smart selection of indicators that are key to sustainably manage sea-based production. In this regard, ocean data will need to be supplemented with coastal and freshwater

data provided on a national or local scale, in order to reach a sufficient resolution and reduce the level of uncertainty.

- Aiming for a **Digital Twin of the Ocean** will require integrating all European assets related to seas and oceans (data, models, physical ocean observatories at sea) with digital technologies (cloud, super high-performance computing capacities, artificial intelligence and data analytics) into a digital component that represents a consistent high-resolution, multi-dimensional description of the ocean. It will be a simulator to test scenarios that deal with different evolutions of the ocean environment according to climate scenarios, anthropogenic stressors or Green Deal policy strategies. It should aim at empowering citizens, governments and industries to collectively share the responsibility to monitor, preserve and enhance marine and coastal habitats, while supporting also a sustainable blue economy (fishing, aquaculture, transport, renewable energy, etc.). It will enable measures to increase resilience to climate change, improve disaster risk-management, develop spatial plans, report on the state of the environment, coastal or offshore activity and measure its impact.

3.2 Regenerating marine and water ecosystems

Marine habitats are very complex and fragile ecosystems. Today, they need a break from human interference. They are impacted by pollution from land and sea, therefore ending marine and freshwaters pollution (see below) is essential for their long-term wellbeing. But before that stage is reached, direct impacts from human activity must be reduced early on, as much as possible. Some urgent actions are needed if we are to save some European marine ecosystems such as the Mediterranean and the Baltic seas.

The good news is that with some help and peace, marine ecosystems can recover quickly and start thriving again to the benefit of both marine and human life. The public discovered it during the few months of lockdown due to Covid-19 pandemic, when several fragile ecosystems were reported as flourishing, such as the Venice canals and lagoon. This is a demonstration that ecosystems can rapidly rebound when pressures are minimised. Therefore, besides stopping pollution, the recovery of marine and freshwater ecosystems rests on a dual approach, halting the net loss of biodiversity by protecting fragile and degraded habitats on the one hand, and actively regenerating marine life on the other hand.

Regeneration of ecosystems is in itself of high value. But it can bring multipurpose benefits that our generation must trigger, for risk of being too late. In other words, natural capital has a value that goes beyond its own existence. On the one hand, it can help generating and regenerating certain blue economy sectors, on the other hand, it is an essential partner to mitigate and adapt to climate change. If well designed and well managed, ecosystem-based management of natural habitats can therefore yield positive economic and climate results.

Therefore, our aim is to:

- Concurrently, **significantly increase the protection of EU waters** through the expansion of the network of marine protected areas (MPAs)⁶⁵ and **launch a pan-European campaign of restoration of marine ecosystems**. Blue forests will demonstrate the blue carbon potential in the restoration of marine vegetation as well as benefits for the blue economy sectors most dependant on a healthy ecosystem (fisheries, aquaculture and tourism).
- **Care for freshwater and groundwater**: The dry summer of 2018 was a wakeup call for many parts of Europe. Countries that traditionally did not face severe droughts have to cope with them. To avoid competition for water between drinking water suppliers, agriculture and industry sectors, water should be used with discretion, primarily to supply drinking water, and abstraction for other purposes, especially agriculture, should be reduced. It is very important to relieve the most valuable water sources (groundwater intakes) by looking for alternative sources for other sectors.

Target 3: 30 percent of EU-waters are highly to fully protected

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • 30 percent of EU-waters are highly to fully protected, with concrete management plans and forming a network of MPAs co-managed by local communities • Total water abstraction has decreased by 50 percent and groundwater abstraction has decreased by 20 percent 	<ul style="list-style-type: none"> • The legal definition of a “highly” and “fully” protected marine area is enshrined in EU law • EU introduces full ban on all activities causing seabed habitat loss or degradation

Target 4: Active regeneration of 20 percent of degraded habitats

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • 20 percent of degraded seabed habitats have been regenerated through removal of pressures, blue reforestation, ecological engineering and full ecosystem-based management of local activities • Ecosystem-based services and nature-based solutions have been scaled up 	<ul style="list-style-type: none"> • A pilot Blue Recovery Nursery has been launched, co-designed with local communities • 10 percent of degraded seabed habitats have been regenerated through removal of pressures, reforestation, other ecological

⁶⁵ Several definitions of Marine Protected Areas have been formulated and applied in different conservation and management contexts. The internationally most commonly cited definition is the following: “Any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (IUCN (1994). Guidelines for Protected Area Management Categories. IUCN, Cambridge, UK and Gland, Switzerland).

by at least 20 percent to improve resilience from sea level rise, floods and coastal erosion

engineering and full ecosystem-based management of local activities

- Ecosystem-based services and nature-based solutions⁶⁶ have been scaled up by at least 10 percent to improve resilience from sea level rise, floods and coastal erosion

- **Regenerate European rivers.** They should recover their natural character, and the path to it is restoring the continuity and hydro-morphology of watercourses. This will require removing obstacles to sediments flow and migration of diadromous species, reducing pressures on water bodies resulting from abstraction, channelisation and embankments, and improving biodiversity. The key driver for restoring the natural flow of rivers will be an EU-wide programme for de-damming rivers.

Target 5: Renaturalise rivers and waters

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • 30 percent of Europe’s rivers are de-dammed. • 30 percent of surface water bodies suffering hydro-morphological pressures are restored 	<ul style="list-style-type: none"> • 15 percent of obsolete dams are removed • 15 percent of surface water bodies suffering hydro-morphological pressures are restored

- **End the most destructive practices for seabed habitats.** To that end, the EU will need an ambitious strategy to move toward low impact fishing and a stronger maritime spatial planning policy to combine high levels of environmental protection and economic development (see Governance).

Target 6: End overfishing

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • The most destructive fishing practices like bottom trawling and other activities causing seabed habitat loss or degradation are phased out • The level of incidental catches of protected and non-target species has decreased by 80 percent • All catches are fully controlled at landing and all vessels above 12 meters are equipped with CCTV 	<ul style="list-style-type: none"> • The EU has adopted a low impact fishing strategy • The number of stocks assessed and managed at sustainable levels has increased by 40 percent in the Mediterranean • All fishing vessels are equipped with geo-positioning systems

⁶⁶ Nature-based solutions are inspired and supported by nature, simultaneously providing environmental, social and economic benefits, and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions (European Commission, <https://ec.europa.eu/research/environment/>).

These ambitious targets entail structural transformations on the part of those economic activities which impact on the seabed and marine ecosystems, are intensive users of water abstracted from rivers and groundwater and are indirect users of infrastructural developments in coastal areas and river basins. If the trade-off between natural and economic capital is to result in favour of nature, major efforts will be necessary to seek the support of citizens and to support innovation, transformation and conversion of these activities and infrastructures (see section 4).

Supporting action plan

- Active regeneration of our seas and rivers will be achieved through removal of pressures on habitats, blue reforestation and other ecological engineering as well as full ecosystem-based management of **local activities**. An integral part of this ambition is to invest in local communities to become co-managers of marine protected areas and ensure an effective protection level of EU waters.
- **The expansion of the network of marine protected areas (MPAs)** will generate important ecological and economic benefits if it is accompanied by a series of important steps and meets a number of objectives: the definition of an MPA should be harmonised at EU level; all MPAs should be covered by effective management plans; the imbalance between coastal waters and offshore waters, a large part of which in the deep sea, should be rectified; the European MPA network should become ecologically representative by including more deeper sea habitats⁶⁷; the overall design of marine protection in Europe should result in a coherent network of MPAs which function together; the involvement of local stakeholders is critical to ensure legitimacy and effectiveness of MPAs.
- A key driver for regeneration would be an **EU Blue Parks Programme**, which will consist of blue reforestation, rewilding and other ecological engineering as well as full ecosystem-based management of local activities. It should start with a Pilot Blue Recovery Nursery that will work with local communities in regions most affected by the crisis, to ensure strict protection of all biodiversity hotspots and regeneration of coastal habitat-building and oxygen-producing species (such as seagrass meadows in the Mediterranean, kelp forests from Ireland to Portugal, river deltas, mangroves and other brackish water and coastal wetlands, salt marshlands, coastal coral and oyster reefs, mussel beds, algae, etc.).
- In addition, each Member State should participate in at least one **large-scale regeneration project** with citizens' stewardship (see Voluntary Corps under citizen engagement).
- Important **tools** to achieve this ambition should be developed at EU level: a methodology to assess the capacity of "marine forests" to absorb and retain CO₂; an assessment for the potential of "blue carbon credits" to be included in

⁶⁷ On these imbalances in favour of coastal waters and some types of habitats, see <https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/marine-protected-areas>

the EU's Emission Trading System; a methodology for defining and assessing ecosystem-based services and nature based solutions; and a knowledge hub (e.g. science-based, stakeholder-driven experts group) tasked with assessing and monitoring the impact of sea level rise on European coasts, and advising on mitigation measures at European, basin, and local scale.

- Full regeneration of marine ecosystems can only be achieved if the most **destructive human practices** at sea are ended, whether they come from fishing, seabed extraction, offshore installations, telecommunication and energy cables, pipelines, coastal development or tourism. To reach that ambition, it will also be necessary to accompany the fisheries sector toward low impact practices (adopting new fishing gears, reducing bycatch of protected species, ending the loss of gears etc.), fully controlled and transparent fishing and adaptation of the fisheries management system toward maximum economic yield. It is also essential that the EU strengthens its longstanding policy of not subsidising capacity enhancing fisheries subsidies (see also section 3.5).
- Beyond fisheries, a broad **cross-sectoral and transnational engagement** between stakeholders and public national and European institutions should prepare the ground, in each sea basin, for an ambitious European phasing out plan of all activities causing seabed habitats destruction or degradation.
- **Inland waters, lakes and rivers** deserve a renewed attention. The most challenging but visible action would be an EU-wide de-damming programme, to remove obsolete dams that prevent sediments and migratory species to freely flow into our rivers and ocean. This will have to be accompanied by new solutions for hydropower plants and mandatory analysis of the impacts on river flows of major coastal developments (construction of breakwaters, jetties, harbours, land reclamation, shore protection measures, etc.) as well as urban wastewater treatment and water use efficiency across all productive sectors. There is also a need to develop site specific solutions for storage of water in the landscape in order to support and protect biodiversity in water and on land at the same time. Sustainable urban drainage systems must be developed and impervious surfaces reduced, particularly in urban areas, so that storm water can seep away instead of flooding sewers and surface waters. We need to pay attention to groundwater: while recharging groundwater systems to secure sources for drinking water, it is necessary to protect ground water dependent ecosystems and for this, to develop adequate methods to do so. Hence the need to also seek site specific solutions for water use and water reuse, for increasing the levels of rainwater retained locally, for encouraging agriculture to use more reused water and more storm water and for finding new, more efficient solutions for irrigation.
- New **digital tools** will be essential for policy makers to access relevant and new, timely scientific knowledge on policy recommendations and developments and reforms (see section 3.1).

3.3 Zero Pollution

Water is a precious good: we drink it, we bath in it, it is the blood of the vegetables and food we eat. And yet, we ignore that any waste or used water we flush will end in a river and in the sea or that many micro particles that remain on our roads or roofs will flow into rivers through rainfalls. In other words, whether visible or not, most solid, liquid or chemical component of what we consume is likely to flow into the sea if not prevented to do so.

Therefore, it is of crucial importance to tackle chemical pollution as a priority at source as the most sustainable and cost-effective measure.

Depolluting European seas and rivers is a major task. It calls for a systemic approach linking fresh- and marine waters, changing industrial, urban and agricultural systems and addressing the four major sources of pollution, excess of nutrients, contaminants, litter and noise. To succeed, the most effective way is preventing pollution at source.

Our aim is to:

- **Do away with marine litter**, especially plastics and micro plastics. Clean-up of plastic pollution is useful to avoid plastic fallout to increase contamination of the deep sea where clean-ups are difficult, if not impossible. However, preventing litter generation at the source is the key, and this means fully embracing the principles of the circular economy: ending single use plastics and fully recycling and reusing other plastics. Crucially, (micro)plastics must be replaced by alternative natural materials, not by seemingly “biodegradable” alternatives which add pollution.

Target 7: Zero plastic litter generation

By 2030	Checkpoints for 2025
<ul style="list-style-type: none">• All plastics on the EU-market are reusable or recyclable• All single-use plastics are banned worldwide	<ul style="list-style-type: none">• The EU has launched a zero plastics-pollution pilot in the Mediterranean Sea and its main river catchments• The EU has banned all single-use plastics and intentionally added micro-plastics• All fishing gears are equipped with geo-positioning detectors

- **Deeply green agricultural practices, shipping and ports.** This means preventing direct pollution from these activities, but also diffuse sources of pollution. This entails a major overhaul of the Common Agricultural Policy to drastically reduce the use and diffuse spill of chemical substances allowed in agriculture. This calls also for a new strategy for green maritime transport and ports.
- **Significantly improve waste water collection, treatment and reuse**, whether in rural areas or in urban areas, whether from household or from

industrial uses, with attention to untreated storm water spillages into rivers and seas.

Target 8: Eutrophication of European seas and waters is halted

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • Losses of nutrients into the environment are reduced by at least 50 percent and the use of fertilisers is reduced by at least 20 percent • Use and risk of chemical pesticides and the use of more hazardous pesticides is reduced by 50 percent • 100 percent of urban wastewater is subject to tertiary (advanced) treatment • All waste waters from ships operating in the European waters is delivered to treatment plants on land 	<ul style="list-style-type: none"> • EU agricultural subsidies are subject to compliance with rate of use of inorganic and organic fertilisers, among other criteria • 100 percent of urban wastewater in designated coastal areas is subject to tertiary (advanced) treatment • 100 percent of wastewater in rural areas is collected and treated

Target 9: Zero spill

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • 50 percent of ships operating in the EU are granted the EU Green shipping label • Waste and container loss from the shipping sector operating in the EU is reduced by at least 75 percent • All ports have facilities to receive waste and wastewaters from ships • The release of micro-pollutants (pesticides, pharmaceuticals, biocides, PFASes) into wastewater treatment plants has been reduced by 50 percent 	<ul style="list-style-type: none"> • An EU Green shipping label is in place for ships operating in the EU rewarding high performance regarding invasive species, SOx, NOx, macro and micro particles, CO2 emissions, waste, oil residues, underwater noise • Waste and container loss from the shipping sector operating in the EU is reduced by at least 50 percent • The access to European ports of vessels equipped with scrubbers (known as open loop systems) is prohibited • The runoff of micro-pollutants (pesticides, pharmaceuticals, biocides, PFASes) into water is reduced by 30 percent. • Dumping of red muds, mining residues and significantly contaminated dredge sediments in rivers and seas is halted

- **Regulate underwater noise.** The EU would be spearheading a new policy that has been underdeveloped until now, acoustic emissions being the least known of all water pollution sources.

Target 10: Underwater noise is regulated and reduced⁶⁸

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> Underwater acoustic emissions are reduced by at least 50 percent Noise impact mitigation measures have been defined in each European marine region and continental sub-aquatic environment 	<ul style="list-style-type: none"> Compulsory regulation on underwater noise from all sources is enacted 30 percent less underwater noise from shipping

Part and parcel of our ambition is to act in a differentiated but coherent way in each European sea basin. The aim for 2030 is that zero litter enters into the European seas (Mediterranean, Atlantic, Baltic, Black and North Sea) including their main river catchments. To that end, it will be essential to work also closely with EU neighbours (see section 3.5). Such an agenda is a formidable opportunity to invent and invest into the development of new materials, recycling technologies, and innovative circular infrastructures and technologies.

Supporting action plan

- The Mission should mobilise citizens and stakeholders for designing and experimenting with solutions and demonstration projects following a systemic approach to prevention of the release of **harmful substances**. Targets are plastics, contaminants and nutrients. This means supporting and accelerating the implementation of measures under the various EU and global legal instruments, including through the development of new materials, recycling, innovative circular infrastructures, etc.
- This should be based on an **assessment** of the state of the environment and the impact pathway of freshwater and marine pollution on biodiversity and human health, so that priorities can be established on a sound basis: on the one hand, “quick wins” areas where we act in priority to generate maximum public/ citizen engagement, and on the other hand, areas where we engage in a much longer term because we still have no clear quantification of the problem and/or effective solutions.
- Achieving zero litter generation means first and foremost a vigorous action on **plastics and micro plastics**, going beyond the current EU directive on single use plastics⁶⁹, and setting high levels of mandatory recycling and waste reduction in packaging, construction materials and vehicles under the EU Circular Economy action plan. Ultimately, it should set in motion a European industrial effort to replace plastics and micro-plastics across the board by

⁶⁸ This does not apply to military vessels.

⁶⁹ The EU Directive on single-use plastics (Directive (EU) 2019/904, OJ (2019) L 155, 12.6.2019, p. 1) bans a limited number of single-use plastics items, requires recycling of plastics bottles in a limited and phased way (at least 25 percent from 2025 and at least 30 percent from 2030), national annual minimum collection rates of fishing gears for recycling, as well as a separate collection rate (77 percent by 2025 and 90 percent by 2029).

recyclable, bio-degradable and/or compostable alternative materials. It is also essential to reduce the rate of micro plastics entering the water cycle from industrial products (car tyres, textiles, etc.) and from consumer goods through the sewage network (personal hygiene products). To that end, informing consumers will be key.

- Halting eutrophication of European seas and waters means focusing primarily on the reduction of the use of **fertilisers** and of diffuse sources of nutrients from farming through the greening of the Common Agricultural Policy on the one hand, and investing in wastewater treatment on the other hand.
- Reaching zero spill of **persistent organic and non-organic pollutants** means primarily reducing discharges into water by applying the precautionary principle, polluter pays principle and extended producer responsibility, and reducing direct discharges into water where relevant and feasible by, for example, updating wastewater treatment to treat important contaminants that are currently not treated, such as pharmaceuticals. It is also necessary to reduce polluted storm water spillages to seas by implementing storm water-management systems which allow full control of storm water flow. At sea, this means vigorous action in ports (all ports should have proper facilities to receive the waste waters from ships) and vessels to halt discharge of fuels and lubricants. Furthermore, this involves combating the introduction of invasive alien species by promoting greater investment in ballast water treatment systems, early detection systems and management programmes and a greater ratification and compliance with the IMO's Ballast Water Management Convention by EU Member States.
- Reducing **underwater acoustic emissions** by at least 50 percent means primarily optimising all possibilities for limiting marine noise such as ship speed reductions, traffic bans and technological improvements in vessels and offshore installations. This requires enhanced knowledge and therefore setting in place a European assessment register and a coordinated monitoring of all anthropogenic sources of underwater noise, as well as promoting innovation like new propellers as a solution to noise reduction. "Noise-free zones" could be designated such as in Particularly Sensitive Sea Areas (PSSAs), Marine protected Areas (MPAs) and in touristic coastal zones. To succeed, it will be important to enhance cooperation between science, tourism operators, nature protection agencies and shipping industry.

3.4 Decarbonising our ocean, seas and waters

We will not halt climate change without the participation of all in the reduction of CO₂ emissions and the mitigation of its impacts. Most of the CO₂ emissions generating climate change and impacting the oceans result from land-based activities, but the blue economy sectors have also their part to play toward carbon neutrality by 2050. Not only should they reduce their emissions, but with a clear and ambitious strategic adjustment plan, the EU could become a "blue leader" with the most innovative and sustainable blue economy in the world.

The challenges are huge, however. Two traditional blue economy sectors are the main CO₂ emitters, shipping and coastal tourism. They are capital intensive and

provide many jobs to coastal communities, and they have been heavily hit by the Covid-19 crisis. In other words, while decarbonisation is essential, and solutions are at hand, adaptation and transition needs to be planned carefully and accompanied by strong EU, national and local policies and financing. Conversely, two sectors offer particularly strong prospects for becoming carbon-neutral and carbon-positive activities, energy and aquaculture. Here as well, solutions are at hand, but Europe needs a coordinated, ambitious policy for planning and supporting their development.

Overall, our aim is to:

- **Make decarbonisation the lever for a completely new EU shipping policy and port strategy.** With the aim to rebuild a fit for the future shipbuilding industry with environmental excellence, the EU should adopt a holistic EU Green Shipping Strategy which will range from decarbonisation and eco-design to dismantling and recycling old vessels. This needs to be accompanied by a new Green Port Strategy that will support the transition toward carbon neutrality and a sustainably planned development of all EU ports.

Target 11: Climate-neutral waterborne transport

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • 100 percent of propulsion engines of leisure boats, fishing vessels and ferries and other short-sea shipping are converted to non-fossil propulsion • CO2 emissions from the shipping sector operating in the EU are reduced by 45 percent • 50 percent of vessels older than 20 years are dismantled and recycled in Europe • 100 percent of European ports are carbon-neutral and provide electricity at berth. 	<ul style="list-style-type: none"> • 50 percent of propulsion engines of leisure boats, fishing vessels and ferries and other short-sea shipping are converted to non-fossil propulsion • CO2 emissions from the shipping sector operating in the EU are reduced by 30 percent • 20 percent of vessels older than 20 years are dismantled and recycled in Europe • 30 percent of ports provide electricity at berth for ferries, cruises and any kind of ships

- **Boost ocean renewable energy to become a key part of the EU energy mix.** The ambition is to cover the energy needs in coastal areas and islands with low-impact offshore renewables, like wind and ocean energy. The EU Offshore Renewable Energy Strategy should allow offshore energy to expand very fast and at unprecedented scale: five-fold by 2030 and twenty-fold by 2030 if the EU is to meet its climate objectives. By contrast, given the political agreement to accelerate clean energy innovation and renewables and the need to align policy to the goals on the Paris Agreement, no new offshore oil and gas exploration licences should be granted.

Target 12: Support the energy transition through renewable, low-impact ocean energy

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> At least 35 percent of the EU energy mix is covered by clean, low-impact, renewable ocean energy (wind, wave, tidal, thermal and salinity gradient energy) 	<ul style="list-style-type: none"> Coastal energy production from low-impact offshore renewable energy has increased by 200 percent 80 percent of the whole energy consumption of the islands is coming from renewables No new offshore drilling for oil and gas is authorised

- Develop zero carbon aquaculture and innovative blue biotechnology.**

The aim is to cover the growth requirements of farmed aquatic organisms in the less carbon-intensive way and with minimal impacts on the aquatic ecosystems and to make Europe the world leader in blue biotech. Energy needs of the aquaculture industry should be covered from non-fossil fuel sources. In the frame of the Green Deal, the EU should promote and incentivise the farming of algae for food and feed, including by funding research on the most nutritious edible species, while the scaling up of blue biotech will require EU coordinated and supported investment in venture capital.

Target 13: Zero-carbon aquaculture

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> The consumption of low trophic aquaculture (e.g. algae, shellfish, other invertebrates) from European waters, and seas has increased by 70 percent 	<ul style="list-style-type: none"> The production of low trophic aquaculture has increased by 100 percent for algae and 20 percent for shellfish and other invertebrates The use of raw materials from sustainable aquaculture for other purposes has increased by 50 percent.

Target 14: A thriving blue biotech

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> The EU is the world leader in blue biotech. The market value of Blue Biotech has reached 200 billion euros 	<ul style="list-style-type: none"> An EU programme for blue biotech development includes funding for venture capital and national programmes for blue biotech start-ups' ideation and acceleration.

- **Support the recovery of coastal tourism through a Blue renovation wave.** Moving to low environmental impacts and low CO₂ emissions is the objective that could regenerate EU tourism by engaging coastal communities to invest in decarbonising infrastructure and buildings (ports, marinas, touristic resorts, etc.), developing new transport waterways across islands and coasts, on rivers and lakes, and promoting alternative eco-touristic models and destinations.

Target 15: Climate-neutral blue tourism

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> • 100 percent of marinas are carbon-neutral and provide electricity at berth • 50 percent of tourism resorts and accommodation are converted to low CO₂ emission and low CO₂ consumption 	<ul style="list-style-type: none"> • Blue belts of green transport infrastructures for connection of coastal areas through EU waterways are designated and funded

Supporting action plan

This Mission’s objective is the most investment and jobs intensive. It is essential that it is accompanied by strong action plans for each sector, which should be composed of a mix of financing from the Next Generation EU package, new legislation, coordination at EU level, strong involvement of local and regional authorities, and particular attention to the needs and skills of people most affected by the transition (see section 3.1).

- **The EU Green Shipping Strategy** will require urgent and strong support. It would be based on: i) developing and spreading carbon neutral propulsion systems, new eco-design of ships, integration of circular economy concepts and spearheading the incorporation of on-board advanced IT technologies; and ii) a dismantling and recycling programme of older vessels. The redevelopment of a shipbuilding industry will require a strategic approach at EU level to avoid unhealthy competition among Member States and ensure full engagement and commitment of the entire value chain (ship building, shipping, cruise and recreational boating, maritime and fluvial ports, port authorities etc.). Retrofitting of ferries and other shipping with renewable propulsion and dismantling of old vessels will require a dedicated financial programme from the EU-budget.
- The EU will also need a new **Green Port Strategy**. The transition toward carbon neutrality will require major investments and innovations of ports and marinas to provide the necessary installations and services for industry and travellers. International competition in shipping and transformation of industrial and consumption patterns will influence the development of maritime transport. The development of off shore activities (energy, telecommunications cables) at EU scale will require cooperation rather than competition among European ports. All these challenges call for close cooperation among a high number of actors.

- Until the full shipping fleet is equipped with carbon-neutral propulsion, an EU **operational shipping speed** should be enacted as soon as possible for the carbon-based fleet.
- While the EU is embarking in a new policy at home, it should also promote decarbonisation globally and fight any unfair competition (see section 3.5).
- Upscaling **offshore renewable energy** requires technology, industry and space: while the EU is already a global leader in offshore renewable energies, upholding this industrial and technological leadership will need research and innovation. Building industrial capacities to the scale needed to reach the objectives; integrating production efficiently in the future energy system (smart grids) will require an ambitious and coordinated investment plan at EU-level. Making space for offshore energy and respecting the marine environment and other sea-users will need to be supported by a stronger maritime spatial planning policy and legislation at EU, national and regional level (see section 3.5).
- There is a challenge but also an opportunity for **decarbonising fresh water management**. Water operators should be enabled to invest more in the generation of renewable energy for example in biogas production, turbines installed along slopes in drinking water and waste water networks, heat exchangers and others. Innovative technologies are needed to develop low GWP sludge management options compliant with the EU's circular economy goals.
- To produce alternative zero-carbon and low environmental impact rich protein through **innovative aquaculture**, a wide range of actions will be necessary. It could go from strengthening its positive effects – including restoration effects - on marine and freshwater habitats to promoting the use of feed ingredients based on low trophic species and of low-energy production technologies, from optimising the discharge management in processing plants to encouraging new offshore and recirculation technologies, from boosting algae and seaweed production for human consumption to cultivating other seaweed and macro- and microalgae as new types of raw materials in fish feed. To achieve this ambition, the EU will need a multi-faceted plan that: asks Member States to designate suitable zones for marine and inland aquaculture by 2025; supports innovation by setting up pilot systems integrating the new techniques and promoting sustainable sourcing of ingredients for feed (research into alternative raw materials); promotes and transforms consumers' acceptance of food based on low-trophic level aquaculture; and facilitates access to EU-markets and local consumption.
- A **Blue low carbon renovation wave for coastal tourism** should embrace energy efficiency, waste and wastewater treatment and new patterns for the food system. It should support all coastal, river deltas and islands communities (including outermost regions) to set in motion a local regeneration strategy based on: on the one hand, decarbonisation of port infrastructures and buildings, marinas passenger transport and tourism resorts and accommodation; on the other hand, transition to sustainable and efficient eco-tourism as a trend, ranging from stimulating local marine and

freshwater food supply, promoting and financing local blue cultural heritage and art as an economic engine of regeneration and renovation, to nature-based touristic offers combining marine protection and regeneration (see section 3.2 and 3.3.) and low impact tourism.

- For all these structural changes to happen, renewed commitment to sustainable **maritime spatial planning** will be essential to leave space to all users of the seas and protect the ecosystems at the same time, while new **digital tools** will be essential for policy makers to access relevant and new, timely scientific knowledge on policy recommendations and developments and reforms (see section 3.1).

3.5 *Revamping governance*

European seas and waters are not effectively governed today, to a large extent because the integrity of Europe's entire water system is not sufficiently understood and acknowledged. But it cannot be managed by dividing it into parts or administratively disconnecting fresh waters from the seas and the ocean. To succeed, the high ambition of the Mission requires strong and effective leadership, with an adequate set of rules, institutions and arrangements designed for reaching the Mission's objectives. This will not be possible without reshaping the approach to ocean and waters governance, into one which proposes, steers and ensures efficient cooperation between different agencies and actors, including civil society, at European, national, international and regional level with a view to implement the outlined Mission objectives.

The ocean is one and the EU has the greatest maritime space in the world (19 million km², against 4.2 million km² of land). Yet, despite its recent efforts to design an EU international ocean governance policy and promote it globally, it still punches under its weight. All major economic and strategic powers are strengthening their maritime capacities, developing countries are the first to depend on healthy oceans and suffer most from climate change, unlawful activities play with governance gaps to spoil marine ecosystems and smuggle illicit goods. The environmental, economic, geopolitical and strategic challenges concerning the ocean are too big for the EU to not deploy its full clout in its own interests, those of its citizens and the defence of the ocean as a global public good.

Our aim is to:

- **Create an integrated and participatory EU-system of ocean and water governance.** It should be steered by the highest level of leadership in the EU, the European Council, framed by an Integrated Ocean and Water Plan for Europe and supported by a new European Ocean and Water Agency. It should promote the active involvement and participation of civil society in the decision-making process. The establishment of a service-oriented EU Ocean and Water Agency is critical to assist in driving the Mission objectives forward.

Target 16: An integrated and participatory EU-system of ocean and water governance

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> A European Ocean and Water Agency is fully established 	<ul style="list-style-type: none"> The legislation creating the European Ocean and Water Agency is enacted The European Blue Citizens’ Forum meets annually since 2021 In 2022, the European Commission presents the first Integrated Ocean and Water Plan for Europe 2022-2030 and in 2025, its first triennial report The European Council convenes the first EU Ocean and Water Summit

- Deploy all EU external instruments at the service of global ocean governance.** Whether in international fora such as the UN, WTO and IMO, in regional organisations for fisheries or environmental protection, or in its bilateral relations, the EU must make ocean regeneration and governance one of its strategic priorities, just as climate change. This implies better and more visible coordination between the EU and its Member States, as well as combining its strong powers in trade, industry, fisheries, environment, and transport policies with its wide presence in all parts of the world to lead a new generation of international agreements on ocean, seas and rivers.
- Develop the EU maritime strategic autonomy.** The goal is to strengthen European capacity to pre-empt and address security challenges affecting people, activities, environment and infrastructure in the maritime domain, whether on its shores or on the high seas, and to combine and enhance its civil and military capabilities at the service of maritime security. Three areas of action should be prioritised: integrate coastguards’ functions at EU level to build a smooth chain of data-information-intelligence; develop joint risk management capacity and carry out joint maritime operations where European citizens and economic interests are at stake and illicit activities are a source of destabilisation; and progressively pool expertise, technology and funds in naval defence.

Target 17: EU leadership for effective global ocean governance

By 2030	Checkpoints for 2025
<ul style="list-style-type: none"> The BBNJ Treaty is enforced [UN] IUU fishing is eradicated globally [UN] International ban on all activities causing seabed habitat loss and degradation takes effect [UN] International UN agreement on protection and management of major rivers is concluded and all major rivers 	<ul style="list-style-type: none"> A robust UN Agreement on areas beyond national jurisdiction (BBNJ) is ratified [UN] International ban on all activities causing seabed habitat loss and degradation is enacted [UN] All harmful fisheries subsidies have been eliminated, including fuel and

of the globe have an internationally supported management plan and national/international commission (EU sponsored set-up and is member of boards of key rivers linked to EU territories, such as Nile, Amazonia, Congo)

- New international standards for harbours, ports and shipping are enacted [IMO]
- All EU bilateral trade agreements condition market access to elimination of IUU fishing and fulfilment of international fisheries agreements
- All maritime surveillance activities of EU agencies and Member States are coordinated and joint surveillance operations in EU and international waters are carried out

new vessel construction subsidies [WTO]

- The EU has identified where international standards for harbours, ports and shipping are missing and leads global efforts for their adoption [IMO]
- The EU has concluded ocean governance agreements with all strategic partners (China, USA, Canada, Japan, South-Korea)
- The EU supports regional ocean governance as part of its partnership and cooperation agreements in Africa, the Pacific and the Caribbean, as well as in South-East Asia and the Indian Ocean
- The EU has concluded circular economy agreements with Mediterranean riparian countries to ban, reuse and recycle plastics
- European maritime surveillance data is streamlined: all data collected by EU Member States and EU agencies on all activities at sea is pooled centrally and made accessible to all coastguards' functions at national and EU level

Supporting action plan:

- The new system of EU ocean and water governance will need to be articulated around key **actors and strategies**. The European Council would call for the Commission to prepare by the end of 2021 an Integrated Ocean and Water Plan for Europe (2022-2030) for the consideration of the European Parliament and the Council. This Plan will position the EU by 2030 as the world leader in ocean regeneration, ocean-climate mitigation, the transformation to a carbon neutral and circular blue economy with a highly engaged citizenry. It will be supported by renewed, ambitious and integrated EU international governance and maritime security strategies.
- EU policy making on ocean and waters should be participatory. Every year, the European Commission, together with the European Parliament, the European Committee of the Regions and the European Economic and Social Committee, should organise a **European Blue Citizens' Forum**. Composed of all segments of society and associating citizen, science, business and local authorities' representatives, it would be the sounding board and proposing platform for discussing how the Mission objectives are delivered across the EU.
- An **EU Ocean and Water Agency** will be created to service the implementation of the Mission. Its mission and functions will be performed in partnership with Member States, their lead agencies and a number of existing EU Agencies, EU Programmes and networks and it will aim at coordinating

Member States as well as supporting the work of the European Commission. It will transparently work for and with the private sector and civil society. Its hybrid nature will require a governance set-up ensuring a fair representation of all stakeholders (Member States, regional authorities, private sector, civil society, research). Its main purpose will be to service the EU-wide Ocean Observation System with fully integrated infrastructure assets capable of delivering and ensuring open data for all data for key societal requirements (climate change, oceanography, meteorology, pollution, ecosystem valuation, seabed mapping). It is recommended that a detailed planning process including wide consultation with Member States and stakeholders be undertaken in 2021 in preparation of the proposal for the EU Ocean and Water Agency.

- The **European Institutions** should adapt their own governance arrangements to ensure appropriate EU political oversight and leadership: the Council and the European Parliament should set up respectively a dedicated European Oceans and Water Council and Committee; the European Commission should establish a multi-Commissioner Ocean and Water Coordination Group under the leadership of its President to prepare and manage the implementation of the Integrated Ocean and Water Plan for Europe.
- The Commission would publish a **triennial progress report** (from 2025) for the European Council on the implementation of the Integrated Ocean and Water Plan and convene a **triennial EU Ocean and Water Summit** featuring prominent citizen engagement event(s).
- Such updated governance will equip the EU to exercise **global leadership** by providing strong strategic directions for its international action. It will lead multilateral efforts to conclude an ambitious agreement on areas beyond national jurisdiction (BBNJ) under the auspices of the UN and an agreement on fisheries subsidies in the WTO, as well as a deep update of the IMO rulebook to decarbonise and green shipping and ship building globally. Regional seas conventions such as OSPAR and the Barcelona Convention should also be considered as essential vehicles to strengthen ocean governance and reinforce protection of the marine environment.
- All **bilateral relations** of the EU with third countries and regional groupings should include a strong ocean protection and governance component. With strategic partners, the EU should aim to include all aspects of its own Integrated Ocean and Water Plan to ensure a level playing field. With less developed partners, development cooperation, support to investment and technical assistance would assist partner countries reaching the SDGs, in particular SDG 14.
- Because of its specific situation, it will be indispensable that the EU exercises leadership in the **Mediterranean** and concludes circular economy partnerships with Mediterranean riparian countries to ban, reuse and recycle plastics.

- As regards **fisheries**, effective management is the best conservation. The EU should lead global efforts to ensure that all aquatic ecosystems will be assessed and managed on the basis of the ecosystem approach. Given the livelihood and food security pressures in many developing regions, sustainability challenges need to be addressed with measures that move beyond protection targets. All fisheries partnership agreements involving the EU should be compatible with sustainable management of fish stocks, protect marine biodiversity and be fair and equitable. International and regional governance mechanisms should be reinforced. Further support to strengthen and reinforce accountability of Regional Fisheries Bodies and Regional Fisheries Management Organisations in pursuit of these goals is essential. Coordinated global capacity building programmes to significantly improve fisheries sustainability is critical in this regard, with specific focus on regions where achieving sustainability is challenging, or where fisheries sustainability status is unknown, with particular attention to data-limited fisheries in developing regions. Finally, the EU bilateral trade agreements should condition market access to elimination of IUU fishing and fulfilment of international fisheries agreements, starting in 2025, at the latest. The EU should support the adoption by the WTO of strong subsidies disciplines with a solid notification and monitoring process and appropriate *de minimis* clauses.

4 THE CONDITIONS FOR SUCCESS

The systemic and cross-cutting character of the Mission and its high level of ambition involves deep, long-term structural transformations. This will require support from society as a whole and strong socio-economic adaptations. Its success also relies on the EU's capacity to innovate and discover new grounds. All this means that a strong implementation plan is necessary.

4.1 *Powerful engagement with society*

Knowing, restoring and protecting our ocean and waters is a shared responsibility, individually and collectively. The proposed targets address variable audiences, depending on their specificity, but overall, they engage a wide range of actors: public authorities at all levels (local, regional national, European), all sectors of the blue economy, civil society organisations, scientific and cultural entities. They should all feel responsible for its success, and crucially, be supported by citizens.

For this, a powerful engagement with society will be necessary. It should address and engage all sectors of the blue economy as well as scientists, artists, authors, educational media and filmmakers to captivate relevance of Mission objectives in all its forms and champion excitement in the exploration, protection and restoration of Europe's ocean and water systems.

The **arts and culture sectors** can play a major role to bridge the knowledge and emotional gap between European citizens and the oceans and freshwaters. But it is imperative to go beyond explaining the state of the hydrosphere as it is. There must also be a creative and inspirational re-imagining of what the human-hydrosphere relationship could be.

Art and culture have been one of the strongest emotive and activating forces in society. This motivational potential can and should also be applied to cultivating and strengthening our emotional bond to the hydrosphere. There is tremendous potential for art and culture in Europe to engage with these intersectional challenges and create work that experientially, educatively and emotionally engages the public with blue environmental issues.

The aim would be:

- Engaging and encouraging independent cultural institutions to focus their programming on blue topics
- Aligning with government bodies focused on blue culture
- Creating a network of independent artists that can work outside of institutional frameworks and empowering them to work on blue topics.

To achieve this goal, concrete initiatives could consist of:

- Major exhibitions and cultural programming across Europe to focus on ecological restoration of the oceans and freshwaters
- Government initiatives of EU member states to be accompanied by national surveys indicating whether an increase is occurring in awareness of blue environmental issues and how they are perpetuated
- Internationally influential artists are thematising blue topics in their art work and mainstream culture too is following suit
- Development of more strategic partnerships between cultural institutions and corporate companies in support of the ocean.

In addition, a strong **communication strategy** will be essential. It would be based on media campaigns and awareness raising actions which also include citizen science initiatives (e.g. Plastic Pirates Programme). It should target all sections of society of all ages to make the water system from source to sink understandable and vitally relevant.

The communication strategy should consist of three strands:

- A communications strategy to improve public understanding and engagement, at both the level of individual and systemic change
- A framing strategy that bridges research and practice, by connecting a broad and deep body of social science to the communications strategy
- A branding strategy to help the popularity and reach of the messaging of the Mission.

Overall, the strategy should aim to achieve the following goals:

- Show that improvements to the health of our water systems are possible and do-able
- Breathe life into the idea of system change
- Normalise action and the need for change (rather than inaction and the status quo)
- Emphasise our shared responsibility for a healthy water cycle
- Highlight the connection between ocean and water health and our health

- Make the Mission objectives feel personal and relatable to each and every citizen.

4.2 A bold investment plan

As the ocean and waters are undergoing an ecological and climate crisis, the proposed Mission objectives must be addressed with planned and systemic investment. Fragmented public policy and market forces will not suffice. There should be a thoroughly planned financial strategy at EU level, which combines EU funded programmes and financial investments with national investment plans and strategies into a coherent and ambitious investment plan for delivering on the Mission.

Investments to protect and restore marine and freshwater nature and ecosystems are not only necessary to ensure the continued supply of the vital goods and services they provide, they also ensure our future prosperity. As outlined in the EU' Biodiversity Strategy for 2030, more than half of global GDP – some €40 trillion – depends on nature. Conserving marine stocks alone could increase annual profits of the seafood industry by more than €49 billion and protecting coastal wetlands could save the insurance industry around €50 billion annually through reducing flood damage losses⁷⁰.

Relevant financing for the necessary **research and innovation** investment to underpin sustainable ocean action is equally lagging behind, when it is already proven that research creates the economy of the future. As outlined by the OECD⁷¹, science and innovative technologies play a central role in developing the ocean economy in a sustainable and responsible manner. Advances in enabling technologies such as remote sensing, modelling and high-performance computing, artificial intelligence and autonomous systems are enhancing our capacity to predict and model the ocean, assess and manage ecosystems and detect and address pollution such as from ballast waters or oil spills. New floating technologies for offshore wind farms, new treatments for ballast water, novel feeds for aquaculture e.g. from algae and improved selection of sites due to enhanced observation systems are among the innovations that may lead to a less polluting, more sustainable and more climate-friendly blue economy⁷².

Sadly, at the beginning of 2020 a new crisis has emerged. Investing in sustainable ocean action during these times of unprecedented emergency might be seen as less urgent, but can in fact constitute an opportunity for a **recovery and deep transformation of the whole economy**. Economic sectors that are currently degrading the health of ocean and waters but which are also dependent on their health, such as fisheries, tourism, shipping and maritime transport, waste and water management will have to undergo transitions to become greener, more sustainable and more climate-friendly. Also, new, sustainable, low impact, uses and resources of the sea, such as offshore renewable energy, innovative aquaculture and blue biotechnology require considerable funding. For

⁷⁰ COM(2020) 380 final. Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions. EU Biodiversity Strategy for 2030 – Bringing nature back into our lives.

⁷¹ OECD. 2019. *Rethinking Innovation for a Sustainable Ocean Economy*, OECD Publishing, Paris

⁷² OECD. 2019. "Science and technology enabling economic growth and ecosystem preservation" in *Rethinking Innovation for a Sustainable Ocean Economy*, OECD Publishing, Paris

this, massive investments are needed. Research and innovation, here as well, have a critical role to play in enabling these transitions, by setting direction and addressing trade-offs and synergies. A massive upscaling of technological, but also of social, governance and business innovation is needed to drive, navigate and accelerate the transitions and to unlock huge opportunities for green growth. To that end, the Mission Board has already made ten concrete proposals for investments to be included in the European Union Recovery Package⁷³.

Europe will need to invest in and **reach out** to citizens and society, since broad public support is required, to regenerate our ocean and waters. The arts and culture sectors in particular have suffered from the Covid-19 pandemic, yet they play a central role in fostering emotional connection, capturing imagination, opening minds and creating new ways to understand and appreciate the world. Citizen science will also be of central importance to reinforce literacy and societal trust in science and foster more participatory and transparent decision-making. Investments in arts, culture and participatory science will help us to come out stronger from the crisis, address the major environmental and social challenges of the ocean and build back better.

Europe also needs to consolidate its ocean and waters **governance** structures. The establishment of a service-oriented EU Ocean and Water Agency should assist in driving the Mission objectives forward. Following a process to make a recommendation for the establishment of a European Ocean and Water Agency, investments will be needed for its set-up and running. But Europe cannot solve the challenges facing the ocean and water alone. The EU should position itself by 2030 as a world leader in ocean regeneration, ocean-climate mitigation, and the transformation to a sustainable, carbon-neutral, circular and thriving Blue Economy with a highly engaged citizens.

Overall, to support reaching the Mission's goal, it is estimated that the investment needs from the EU funding and from national public and private sources would total around EURO 500 billion over the period 2021-2027 (see details in Annex 1). The investment needed would be around **EURO 70 billion every year**, or 0.5 percent of the EU GDP in 2019 (EURO 13.900 billion at current price).

⁷³ 2020. Regenerating Our Ocean and Waters. Interim Report of the Mission Board Healthy Oceans, Seas, Coastal and Inland Waters. Annex III, pp. 34-56. June 2020. <https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/d0246783-b68a-11ea-bb7a-01aa75ed71a1>

Table 2. Assessment of investment needs (2021-2027, million Euros)

Objective	Target		Total	Of which R&D needs
<i>Filling the knowledge and emotional gap</i>	1	Each European is a citizen of the ocean and waters	900	130
	2	Marine and freshwater observation is streamlined and accessible to all via a digital twin of the ocean and all waters	1160	150
<i>Regenerating marine and water ecosystems</i>	3	30 percent of EU waters are highly to fully protected	66 600	250
	4	Active regeneration of 20 percent of degraded habitats	15 500	
	5	Renaturalise rivers and waters	8 000	
	6	End overfishing	3 500	300
<i>Zero pollution</i>	7	Zero plastic litter generation	600	450
	8	Eutrophication of European seas and waters is halted	154 000	600
	9	Zero spill		
	10	Underwater noise is regulated and reduced		*
<i>Decarbonising our ocean, seas and waters</i>	11	Climate-neutral waterborne transport	6 000	*
	12	Support the energy transition through renewable, low-impact ocean energy	200 000	200
	13	Zero-carbon aquaculture	600	150
	14	A thriving blue biotech	10 000	1 000
	15	Climate-neutral blue tourism	60 000	
<i>Revamping governance</i>	16	An integrated and participatory EU-system of ocean and water governance	100	40
	17	EU leadership for effective global ocean governance	60	30
Total			527 020	3 300

Figures are based on rough estimates which do not distinguish between public or private investments, nor between European Union or Member States funding streams.

5 CONCLUSION

The proposed Mission is:

- **Bold and inspirational:** Regenerating our ocean and waters is vital for human existence, wellbeing and the livelihoods of European citizens. The ocean and waters are the essential reason that humanity enjoys a stable, life-sustaining climate. The connected water system is the origin of all life on Earth and all forms of life depend on it. By 2030, Europe's entire water cycles will be revealed as never before so that the whole society engages and cares about the need for healthy regenerated oceans, seas, coastal and inland waters and a new economic model will have emerged.
- **Ambitious:** The proposed Mission not only aims to halt the degradation of the water and marine ecosystems but seeks to regenerate their health thus making an ambitious and positive contribution, which will require a concerted effort at European, national, local and global level. Moreover, there is growing international momentum for regenerating the ocean and waters and by 2030, the EU leadership will have moved sustainable ocean governance forward.
- **Measurable and time-bound:** Activities and proposed outcomes are a set of concrete targets for 2025 and 2030 defined for each of the five main objectives.

The Mission will support many **Sustainable Development Goals**. Regenerating our ocean and waters will directly contribute to SDG 14 - Conserve and sustainably use the oceans, seas and marine resources for sustainable development⁷⁴ and SDG 6 - Ensure availability and sustainable management of water and sanitation for all⁷⁵. It will interact with most of the other SDGs (see Figure 8). Amongst other, the water cycle plays a central role in the Earth and climate system, thus affecting climate action (SDG 13) and life on land (SDG 15). Regenerated ecosystems provide food security (SDG 2) and sustain livelihoods (SDG 1). Moreover, a decarbonised blue economy can provide affordable and clean ocean energy (SDG 7), foster circular and responsible production and consumption patterns (SDG 12), thus improving the sustainability of cities and communities (SDG 11) and providing decent work and economic growth (SDG 8). Moreover, the strong research, innovation and training fostered by the proposed Mission will provide strong innovation (SDG 9) and quality education (SDG 4). Last but not least, the proposed Mission would not be successful without engaging in global partnerships (SDG 17).

⁷⁴ incl. targets 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.A, 14.C

⁷⁵ incl. targets 6.1, 6.3, 6.4, 6.5, 6.6, 6.A, 6.B

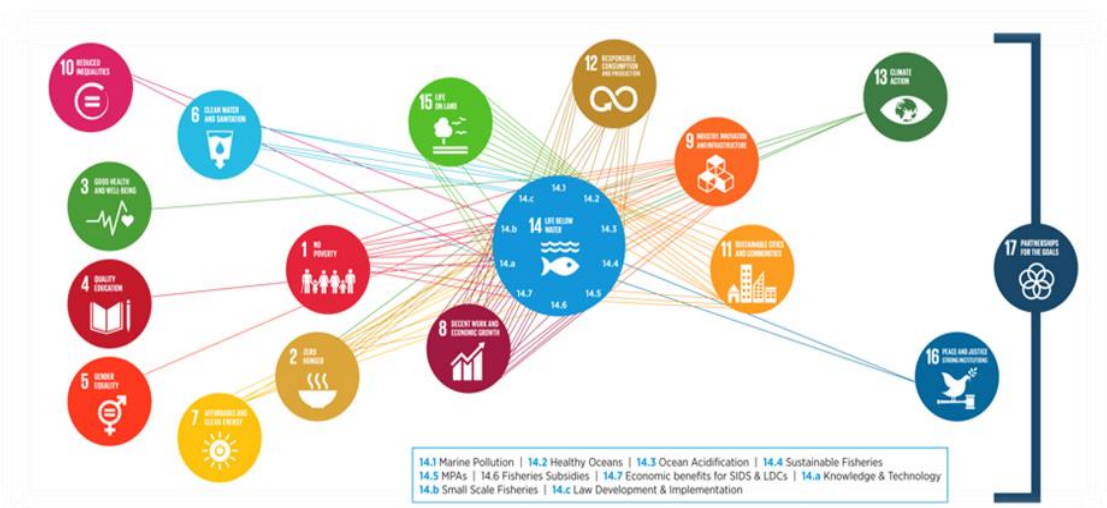


Figure 8. SDG 14 Interaction with other SDGs⁷⁶

The transboundary nature of the ocean, seas and rivers necessitates cooperation across regions, countries, sectors. To achieve the regeneration objective, the **EU added value** lies in the multiple measures and solutions that will need to be deployed at various scales across the continent – and beyond.

The Mission will contribute to **other Horizon Missions**:

- Mission in the area of climate change adaptation including societal transformation:
 - *Regeneration of marine and freshwater ecosystems, which sequester and act as carbon sinks.*
 - *Increased climate resilience of coastal communities, incl. through nature-based solutions and the restoration of ecosystems providing protection from sea level rise, flooding, and coastal erosion.*
 - *Increased understanding of and knowledge of the climate-ocean nexus.*
- Mission in the area of climate-neutral and smart cities:
 - *Improvement of treatment of urban wastewater and pollution prevention.*

⁷⁶ Schmidt et al. 2017. "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" in International Council for Science, 2017. *A Guide to SDG Interactions: from Science to Implementation*. International Council for Science: Paris

- *Blue renovation and decarbonisation of the blue economy and coastal communities with green/blue port building, infrastructures, marinas, tourism resorts.*
- Mission in the area of soil health and food:
 - *Develop food from the ocean and waters thereby reducing the pressure on soils.*
- Mission in the area of cancer:
 - *Increased pharmaceutical research and medicine available for cancer treatment originating from blue biotechnology.*

Finally, the Mission will contribute to many ongoing **processes at EU and international level** by scaling up their level of ambition, going beyond their current objectives of timeframe, adding new objectives and/or proposing new action. It will provide game-changing ideas, solutions that will help to raise the ambitions and accelerate the necessary transitions. Annex 2 provides an inventory of the key EU policies which the Mission proposal would support, as well as EU programmes and instruments that would need to be mobilised to deliver on the Mission proposal. This inventory shows that the EU is already working to address in one way or another many of the objectives and targets identified in this report.

6 ANNEXES

6.1 ANNEX 1 - Overall investment needs linked to the Mission Starfish 2030

(Figures are based on rough estimates. They do not distinguish between public or private investments, nor between European Union or Member States funding streams)

Objective		Target	Sub-target	Amount (in €)	Of which R&D needs (2021-2027)
<i>Filling the knowledge and emotional gap</i>	1	Each European is a citizen of the ocean and waters	A pan-European education programme on ocean and waters is implemented; A pan-European ocean literacy coalition is created; European regeneration voluntary corps has been created and have branches in all European countries; The Blue ERASMUS programme enables students and apprentices to broaden their knowledge on ocean and waters from an interdisciplinary social and natural science perspective throughout Europe.	800 million	130 million
			At least 50 percent of the European blue workforce has been upskilled or re-skilled.	100 million	
	2	Marine and freshwater observation is streamlined and accessible to all via a digital twin of the ocean and all waters	Global digital twin of all oceans and waters is operational;	100 million Estimated development cost of the Digital Twin of the Earth System	60 million

			(Destination Earth initiative): 225 million. The Ocean Twin is part thereof.	
		Global marine and freshwater observation is streamlined: all data collected is pooled centrally and made accessible to all;	250 million over 10 years. Operations & maintenance 36.8 million per annum.	
		Global high-resolution ocean forecasting and regional ocean climate services are operational to support climate change adaptation at coastal scale	240 million over 10 years 90 million for development (blue, green, white, brown ocean) Operations and maintenance 15 M€/year	
		The European seabed is fully and coherently mapped in high-resolution	70 million Range of €50m (based on the ship time rates from Irish seabed survey €23K day) and €87.6m (arrived at using typical US day rates of \$50K/day) ⁷⁷ .	

⁷⁷ Estimate as if the ship time was being bought for “new” while with most of the survey fleet in state ownership with built in overhead provided for by annual exchequer budgets much of the mapping could be achieved by a policy decision to allocate time for this purpose could reduce “new” costs substantially.

			50 percent of DNA of life in our ocean and waters is fully sequenced;	500 million ⁷⁸ Example from Census of Marine Life: US\$ 650 million for a decade of discovery involving 2,700 scientists, 80+ nations, 540 expeditions, 2,600+ scientific publications, 6,000+ potential new species, 30 million distribution records and counting	
<i>Regenerating marine and water ecosystems</i>	3	30 percent of EU waters are highly to fully protected	30 percent of EU waters are highly to fully protected, with concrete management plans forming a network of MPAs co-managed by local communities	6 500 Million per year (Assuming average annual costs of 2225 EUR/km2 and considering that 11 percent of European Waters are already designated as MPAs).	250 million over 5 years for place-based demonstrators and upscaling lighthouses: 50 million /year
			Total water abstraction has decreased by 50 percent and	1 600 Million ⁷⁹	

⁷⁸ Difficult to provide figures, as there is no baseline. Estimates are that up to 98 percent of species type still remain undescribed. For further information please see: <https://www.nature.com/articles/s41893-020-0522-9>

⁷⁹ Based on JRC 2012. A multi-criteria optimisation of scenarios for the protection of water resources in Europe. Available at https://ec.europa.eu/environment/water/blueprint/pdf/EUR25552EN_JRC_Blueprint_Optimisation_Study.pdf

The "Irrigation efficiency" was found to improve both the Water Exploitation Indices, especially in the Danube (12.6 percent), Iberia/Mediterranean (11.8 percent), Sicily (12.7 percent), South Italy (11.8 percent), Sardinia (12.6 percent), Greece/Evros (12.1 percent) and France Atlantic (9.8 percent), but also it reduced groundwater abstraction by around 20 percent in all the regions. The "Irrigation efficiency" scenario, assumes that the current irrigation efficiency is improved from current average 74 percent (Eastern Europe) - 77 percent (Western Europe) to 93 percent by applying drip irrigation everywhere where it is not yet applied. Costs are estimated at 153 Euro/ha where drip irrigation is not applied yet. According to literature, current drip-irrigation areas currently cover 3 percent in Eastern Europe, and 18 percent in Western Europe. Costs are again adjusted for national price levels. The overall cost for the 21 regions amount to about 1.6 billion €.

			groundwater abstraction has decreased by 20 percent	
	4	Active regeneration of 20 percent of degraded habitats		
			20 percent of degraded seabed habitats have been regenerated through removal of pressures, blue reforestation, ecological engineering and full ecosystem-based management of local activities	15 000 million (Calculated on the basis that it costs approx. 140,000-370,000 EUR per ha of restored marine habitats, depending on local costs).
			Ecosystem-based services and nature-based solutions have been scaled up by at least 20 percent to improve resilience from sea level rise, floods and coastal erosion	500 million ⁸⁰ Example of "sand motor" project in South Holland: 70 million euros (50 million CapEx + 20 million OpEx) ⁸¹
	5	Renaturalise rivers and waters	30 percent of Europe's rivers are de-dammed; 30 percent of surface water bodies suffering hydro-morphological pressures are restored	8 000 million (assuming that 75 percent of dam removals would be small projects at 50.000 EUR, 24 percent medium projects at 500.000 EUR and final 1

⁸⁰ Figures are difficult to estimate given the need for establishing a baseline

⁸¹ <https://climate-adapt.eea.europa.eu/metadata/case-studies/sand-motor-2013-building-with-nature-solution-to-improve-coastal-protection-along-delfland-coast-the-netherlands/>

				percent large projects at 10 million each)	
	6	End overfishing	<p>The most destructive fishing practices like bottom trawling and other activities causing seabed habitat loss or degradation are phased out;</p> <p>The level of incidental catches of protected and non-target species has decreased by 80 percent;</p> <p>All catches are fully controlled at landing and all vessels above 12 meters are equipped with CCTV</p>	<p>3 500 million</p> <p>EMFF 2014-2020 has a budget of 6.4 billion of which 3.5 billion could go towards management, implementation and control in fisheries.</p>	300 million
<i>Zero pollution</i>			<p>Designing and experimenting solutions and demonstration projects following a systemic approach to prevention of the release of harmful substances. Targets are plastics, contaminants and nutrients</p>		250 million over 5 years Place based demonstrators and upscaling lighthouses: 50 m EUR/year
	7	Zero plastic litter generation	<p>The EU has banned all single-use plastics and intentionally added micro-plastics;</p> <p>All fishing gears are equipped with geo-positioning detectors;</p> <p>All plastics on the EU market is reusable or recyclable;</p>		200 million over 5 years Materials and technology development for innovative alternatives to plastics: 40 m EUR/year
			<p>The EU has launched a zero plastics-pollution pilot in the Mediterranean Sea and its main river catchments</p>	<p>150 million</p> <p>Pooling together of existing national and EU and international initiatives in the MED;</p>	

				30 million EUR for coordination and supporting this and further funding to establish necessary infrastructure for recycling and reuse 100 million EUR	
8	Eutrophication of European seas and waters is halted	<p>100 percent of urban wastewater is subject to tertiary (advanced) treatment;</p> <p>All waste waters from ships operating in the European waters is delivered to treatment plants on land;</p> <p>100 percent of wastewater in rural areas is collected;</p> <p>The release of pharmaceuticals into wastewater treatment plants has been reduced by 50 percent</p>	<p>150 000 million</p> <p>According to a recent OECD/EC study (currently discussed at OECD EPOC), total cumulative additional expenditures by 2030 for water supply and sanitation amounts to EUR 289 billion for the EU Member States to comply with the DW and UWWT Directives and to enhance the efficiency of water supply systems. This would represent an average increase of annual expenditures for water supply and sanitation by 45 percent in order to comply with the directives.</p>	600 million	For water related R&I activities over the next 7 year period, of which about 150 M€ to circular economy approaches in the wastewater treatment plants.
		Reduce water loss	4 000 million	Example Belgium: Distribution losses (including leakage) amount to about 20	

				percent. The current renewal rate is below 0.5 percent. This is far too low if the lifetime of pipes is estimated at 50 years. A 2 percent renewal rate (of the 100,000 km distribution network) would cost 200,000 EUR/km = 400 million EUR/year.	
			EU agricultural subsidies are subject to compliance with rate of use of inorganic and organic fertilisers, among other criteria; Use and risk of chemical pesticides and the use of more hazardous pesticides is reduced by 50 percent		
	9	Zero spill	For targets on the release of pharmaceuticals into wastewater treatment plants, see wastewater treatment above. (For targets on shipping, see climate-neutral maritime transport, below)		
	10	Underwater noise is regulated and reduced	(see climate-neutral maritime transport, below)		
<i>Decarbonising our ocean, seas and waters</i>	11	Climate-neutral waterborne transport	50 percent of ships operating in the EU are granted the EU Green shipping label Waste and container loss from the shipping sector operating in	4 000 million	

		<p>the EU is reduced by at least 75 percent</p> <p>Underwater acoustic emissions are reduced by at least 50 percent</p> <p>100 percent of propulsion engines of leisure boats, fishing vessels and ferries and other short-sea shipping are converted to non-fossil propulsion</p> <p>CO2 emissions from the shipping sector operating in the EU are reduced by 45 percent</p> <p>50 percent of vessels older than 20 years are dismantled and recycled in Europe</p>		
		<p>100 percent of European ports are carbon-neutral and provide electricity at berth</p> <p>100 percent of marinas are carbon-neutral and provide electricity at berth</p> <p>Blue belts of green transport infrastructures for connection of coastal areas through EU waterways are designated and funded</p>	<p>1 500 million</p> <p>7.4m EUR/ medium-sized port (overall capital cost of installing electricity in ports (cold ironing technology) in medium-sized ports. = 750 million EUR for 100 ports.</p> <p>Upgrading ports to handle offshore wind installation will cost approx. 750 million EUR.</p>	
		<p>All ports have facilities to receive waste and wastewaters from ships</p>	<p>500 million</p>	

	12	Support the energy transition through renewable, low-impact ocean energy	At least 35 percent of the EU energy mix is covered by clean, low-impact, renewable ocean energy (wind, wave, tidal, thermal and salinity gradient energy)	200 000 million Considering installation ⁸² of at least 70 GW offshore wind in the next 10 yrs, an investment of around 200 bn Euro is needed. Average 20 bn Euro/year CAPEX.	200 million
	13	Zero-carbon aquaculture	The consumption of low trophic aquaculture from European waters, and seas has increased by 70 percent.	600 million	150 million
	14	A thriving blue biotech	The EU is the world leader in blue biotech: The market value of Blue Biotech has reached 200 billion Euro	10 000 million ⁸³	1 000 million
	15	Climate neutral-blue tourism	50 percent of tourism resorts and accommodation are converted to low CO ₂ emission and low CO ₂ consumption	60 000 million Early estimates indicate that the deep renovation of 50 percent of hotels in Europe would cost 58,3 billion EUR. ⁸⁴	

⁸² Sectoral breakdown: WindEurope estimate €15 billion for power and €3 billion for grids for the current emission targets. It will be about 35 percent more for the new targets currently being assessed so it means €20 billion for power plants and 4 billion for grids (annually).

⁸³ The global market for marine biotechnology products and services is a significant and growing opportunity. It has the potential to rise to over 5 billion by 2025 [(OECD, The Ocean Economy in 2030 (2016), and Marine biotechnology strategic research & innovation roadmap, Marine Biotechnology ERA-NET (2016)]

⁸⁴ Lamy, Pons et al (2020). Greener After.

<i>Revamping governance</i>	16	An integrated and participatory EU-system of ocean and water governance		100 million	40 million
	17	EU leadership for effective global ocean governance		60 million	30 million

6.2 ANNEX 2 - European Union Policies, Programmes, Instruments and Regulations Contributing to The Mission Starfish 2030

Objective	Target	EU Policies ⁸⁵ , Regulations	EU Programmes and Instruments
<i>Filling the knowledge and emotional gap</i>	<p>1</p> <p>Each European is a citizen of the ocean and waters:</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> • Literacy and knowledge about the water system are compulsory elements in all science curricula in primary and secondary schools throughout the EU • 50 percent of Europeans has participated in events organised by the pan-European ocean literacy network • At least 50 percent of the European blue workforce has been upskilled or re- 	<ul style="list-style-type: none"> • European Education Area: The European Commission announced its intention to create the European Education Area in November 2017 consisting of actions to make mobility a reality for all (EU Student Card), mutual recognition of diplomas (new Sorbonne process building on the Bologna process), greater cooperation on curricula development, improving language learning, promoting life-long learning (increase share of people engaging in life-long learning to 25% by 2025), mainstreaming innovation and digital skills in education (new European Digital Action Plan), support for teachers (eTwinning network), creating network of European Universities, investing in education (Member States to invest 5% of GDP in education), 	<ul style="list-style-type: none"> • Horizon Europe • The Erasmus Programme, which can contribute to the development of new curricula, short courses and teacher training programmes across all sectors of education. It also supports sport, youth participation, youth work and dialogue with policy-makers. • The European Universities Initiative (funded through Erasmus+ and Horizon 2020), which has a strong sustainable development component. • The Marie Skłodowska-Curie Actions (under Horizon

⁸⁵ The Mission Healthy Oceans, Seas, Coastal and Inland Waters supports the European Green Deal overall. In addition, several objectives and targets support other policy areas.

	<p>skilled</p> <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> • A pan-European education programme on ocean and waters is implemented • ocean literacy coalition of civil society organisations, youth organisations and schools, museums, aquaria and cultural centres and events is created • A European regeneration voluntary corps has been created and have branches in all European countries • 20 percent of data collections comes from citizen’s science initiatives • European academic institutions coordinate and implement a coherent Europe-wide marine science curriculum and strategy for marine science • The Blue ERASMUS programme enables students and apprentices to broaden their knowledge on ocean and waters from an interdisciplinary social and natural science perspective throughout Europe • Member States most 	<p>preserving cultural heritage (European agenda for Culture and other initiatives), strengthening European dimension of Euronews⁸⁶.</p> <p>The Communication from the European Commission on achieving the European Education Area by 2025 is planned for 2020.</p> <ul style="list-style-type: none"> • European Research Area (Articles 179 – 190 TFEU): The EU should achieve the European Research Area in which researchers, scientific knowledge and technology circulate freely. For this purpose, the EU shall among others, support undertakings, research centres and universities in their research and technological development of high quality, their efforts to cooperate with one another, including demonstration projects. This is achieved among others through the Multiannual Framework Programme (Horizon Europe) that sets out Union activities in the area of research and technological development: with scientific and technological objectives, broad lines of activities and fixes Union financing for these activities. The European Commission Communication A new ERA for Research and Innovation is planned for 2020. 	<p>Europe), which can fund bottom-up frontier and applied research projects in the form of postdoc fellowships, doctoral programmes and collaborative staff exchanges.</p> <ul style="list-style-type: none"> • The “Researchers at Schools” initiative, which will bring science to schools by allowing young researchers supported by the Marie Skłodowska-Curie Actions to engage with teachers and pupils on climate change, sustainable development, health, other issues covered under the European Green Deal, as well as other Commission priorities. • The European Institute of Innovation and Technology (EIT) and in particular the EIT Climate Knowledge and Innovation Community (Climate-KIC), which has a strong portfolio of innovation initiatives to support the Missions. • The EU4Ocean coalition, an EU ocean literacy hub.
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⁸⁶ Source: https://ec.europa.eu/commission/presscorner/detail/en/IP_17_4521.

	<p>affected by the Covid-19 crisis have up-skilled and re-skilled 25 percent of their blue economy</p>		<ul style="list-style-type: none"> • The Atlas for the Seas initiative/instrument, a tool to teach ocean literacy at schools available in all EU languages from the 16th of September. • The European Solidarity Corps, where climate action, environment and nature protection are increasingly popular topics. • The Creative Europe Programme, which can contribute to the Mission's objectives from a cultural and audio-visual perspective, raising awareness among citizens and bringing them closer to the issues at hand • European Social Fund, investment in education, lifelong training/retraining, promoting labour mobility and social inclusion, transnational cooperation • European Regional Development Fund, investments in educational and environmental infrastructure, networking, cooperation and capacity building • The Copernicus academy and the Copernicus relays, investment in the Copernicus skill programme and inclusion of Copernicus use in
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		<p>2 Marine and freshwater observation is streamlined and accessible to all via a digital twin of the ocean and all waters</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> • Global digital twin of all oceans and waters is operational • Global marine and freshwater observation is streamlined: all data collected is pooled centrally and made accessible to all • Global high-resolution ocean forecasting and regional ocean climate services are operational to support climate change adaptation at coastal scale • The European seabed is fully and coherently mapped in high-resolution • 50 percent of DNA of life in our ocean and waters is fully sequenced and publicly available <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> • European digital twin pilot of European oceans and waters 	<ul style="list-style-type: none"> • Shaping Europe's Digital Future: Destination Earth, initiative to develop a high precision digital model of Earth (a "Digital Twin of the Earth") that would improve Europe's environmental prediction and crisis management capabilities. • EU Chemicals Strategy for Sustainability aims to close knowledge gaps inter alia by collecting and bringing together biomonitoring data on data on exposure. • Under the All-Atlantic Ocean Research Alliance, based on the Galway and Belém Statements, the EU together with international partners are coordinating their efforts to jointly map the seabed and create an integrated ocean observation system. • Space regulation - Copernicus programme, the Copernicus marine service and the Climate change service continue to evolve in resolution, forecasts and projections to improve ocean health monitoring and adaptation to climate change in coastal areas and over the Arctic. 	<p>educational training related to oceans</p> <ul style="list-style-type: none"> • Horizon Europe • Digital Europe • Copernicus • European Maritime and Fisheries Fund (EMFF) also promotes ground data collection, processing and monitoring which can be used for scientific purposes. • The European Marine Observation and Data network (EMODnet)
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		<p>is operational</p> <ul style="list-style-type: none"> • European marine and freshwater observation is streamlined: all data collected by EU Member States is pooled centrally and made accessible to all. • The Copernicus programme deploys coastal-scale ocean forecasting and climate services • The North Atlantic Seabed is fully and coherently mapped in high-resolution • 20 percent of DNA of life in our ocean and waters is fully sequenced and publicly available 		
Regenerating marine and water ecosystems	3	<p>30 percent of EU waters are highly to fully protected</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> • 30 percent of EU waters are highly to fully protected, with concrete management plans and forming a network of MPAs co-managed by local communities • Total water abstraction has decreased by 50 percent and 	<ul style="list-style-type: none"> • The EU Biodiversity Strategy for 2030⁸⁷ requires that by 2030, at least 30 percent of the land (hence including freshwater ecosystems) and 30 percent of the sea should be protected in the EU, which is a minimum of an extra 4 percent for land and 19 percent for sea areas as compared to today. The strategy also requires strict protection for areas of very high biodiversity value or potential, representing 10 percent of EU land and 10 percent of EU sea, compared with the current situation of 3 percent of land and less than 1 	<ul style="list-style-type: none"> • Horizon Europe incl. proposed European Partnership 'for rescuing biodiversity to safeguard life on Earth'⁸⁸ • EMFF provides funding possibilities for marine conservation measures • NextGenerationEU, including Recovery and Resilience Facility • LIFE programme: sub-

⁸⁷ COM(2020) 380 final, page 4

⁸⁸ The full list of proposed European partnership candidates: https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme/european-partnerships-horizon-europe_en

	<p>groundwater abstraction has decreased by 20 percent</p> <p><u>Checkpoints for 2025:</u></p> <ul style="list-style-type: none"> • The legal definition of a “highly” and “fully” protected marine area is enshrined in EU law • EU introduces full ban on all activities causing seabed habitat loss or degradation, including destructive fishing practices and deep seabed mining 	<p>percent of marine areas that are strictly protected in the EU. The Commission will produce by 2020 criteria and guidance for identifying and designating additional protected areas and ecological corridors, and by 2024 will assess EU’s progress in meeting its 2030 targets on protected areas and whether additional action, legislative or other, is needed. The implementation of these protected areas will take place through the Marine Strategy Framework and Maritime Spatial Planning Directives</p> <ul style="list-style-type: none"> • Extension and intensification of the level of protection of freshwater ecosystems will also be considered through the implementation of the Water Framework Directive (IPBES report shows that the greatest decrease in biodiversity occurred in freshwater) • Work under MSFD Good Environmental Status Descriptor 6 on seabed provides the framework for identifying and addressing main pressures. A “full ban on all activities causing seabed habitat loss or degradation” is not foreseen in article 14.1.d. of the MSFD, which includes exceptions for reasons of overriding public interest, such as navigational dredging. • The Water Framework Directive does not include any explicit requirements on absolute water abstraction but it does address water quantity in several ways: Water quantity is, for example, implicitly included in the definition of good ecological status and explicitly in hydro-morphological elements (i.e. flow regime). Furthermore, good 	<p>programme for the Environment, priority area Nature and Biodiversity (under the current system).</p> <ul style="list-style-type: none"> • European Regional Development Fund, support for investments to protect and restore biodiversity and promote ecosystem services • Cohesion Fund, support for investments to protect and restore biodiversity and promote ecosystem services • EU Taxonomy to help investors, companies, issuers and project promoters navigate the transition to a low-carbon, resilient and resource-efficient economy
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		<p>quantitative status is required for groundwater, where Member States must ensure a balance between abstraction and recharge rates. BDS2030 Action Plan mentions that the Commission will produce by 2023 a technical guidance to Member States on their measures to review water abstraction and impoundment permits and to restore ecological flows in the revised WFD River Basin Management Plans.</p> <ul style="list-style-type: none"> • The Maritime Spatial Planning Directive envisages that all Member States shall have Maritime Spatial Plans in place by 2021. • Common Fisheries Policy 	
	<p>4 Active regeneration of 20 percent of degraded habitats</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> • 20 percent of degraded seabed habitats have been regenerated through removal of pressures, blue reforestation, ecological engineering and full ecosystem-based management of local activities. • Ecosystem-based services and nature-based solutions have been scaled up by at least 20 percent to improve resilience from sea level rise, floods and coastal erosion <p><u>Checkpoints for 2025:</u></p>	<ul style="list-style-type: none"> • Biodiversity Strategy for 2030 announces that, subject to an impact assessment, the Commission will put forward a proposal for legally binding EU nature restoration targets in 2021 to restore degraded ecosystems, in particular those with the most potential to capture and store GHG emissions and to prevent and reduce the impact of natural disasters. • Prioritisation of actions will be performed in the context of both Water Framework and Marine Strategy Framework Directives. Mapping and Assessment of Ecosystem Services and Natural Capital Accounting in on-going at Member States and EU level, under the framework of the Biodiversity Strategy, that could support the establishment of targets based on specific ecosystem services for which quantification is more advanced. 	<ul style="list-style-type: none"> • Horizon Europe, incl. proposed European Partnerships 'Water4All', 'Partnership for rescuing biodiversity to safeguard life on Earth' and 'A climate neutral, sustainable and productive Blue Economy' • LIFE programme: sub-programme for the Environment, priority area Nature and Biodiversity (under the current system). • Possible EU membership to International Coral Reef Initiative (ICRI) and possible EU participation to the G20 Global Coral R&D Platform.

	<ul style="list-style-type: none"> • A pilot Blue Recovery Nursery has been launched, co-designed with local communities • 10 percent of degraded seabed habitats have been regenerated through removal of pressures, reforestation, other ecological engineering and full ecosystem-based management of local activities • Ecosystem-based services and nature-based solutions have been scaled up by at least 10 percent to improve resilience from sea level rise, floods and coastal erosion 		
5	<p>Renaturalise rivers and waters</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> • 30 percent of Europe's rivers are de-dammed • 30 percent of surface water bodies suffering hydromorphological pressures are restored <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> • 15 percent of obsolete dams are removed • 15 percent of surface water bodies suffering hydromorphological pressures are restored 	<ul style="list-style-type: none"> • Biodiversity Strategy 2030 Action Plan indicates that by 2021 the Commission will produce guidance and support to Member States to identify sites and help mobilise funding for the restoration of 25,000 km of free-flowing rivers. • Member States are working on restoring river continuity and addressing hydromorphological pressures in the context of the Water Framework Directive. Experience proves that de-damming is a long and costly process and that alternatives have to be considered, such as fish passes. 	<ul style="list-style-type: none"> • Horizon Europe, incl. proposed European Partnership 'Water4All' • LIFE programme: priority area Environment and Resource Efficiency, Water and Marine Environment.

	6	<p>End overfishing</p> <p><u>By 2030</u></p> <ul style="list-style-type: none"> • The most destructive fishing practices like bottom trawling and other activities causing seabed habitat loss or degradation are phased out • The level of incidental catches of protected and non-target species has decreased by 80 percent • All catches are fully controlled at landing and all vessels above 12 meters are equipped with CCTV <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> • The EU has adopted a low impact fishing strategy • The number of stocks assessed and managed at sustainable levels has increased by 40 percent in the Mediterranean • All fishing vessels are equipped with geo-positioning systems 	<ul style="list-style-type: none"> • The Common Fisheries Policy (CFP) aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable and that they provide a source of healthy food for EU citizens. • One of the main targets of the CFP is to manage all fisheries at Maximum Sustainable Yield (MSY) by 2020. In the Med, the attainment of MSY is set for 2025. • As regards non-target species, Regulation 1380/2013 has established a landing obligation in order to reduce discarding of unwanted catches. This requirement is in force as of 2015 (gradually) and 2019 (fully). However, the issues of enforcement remain as it is difficult to police every fishing vessels on the sea. So the need is there for modern technology for control and enforcement. As regards by-catch of protected species, there are also illegal to catch. As the fishermen do not want to catch these, the issue is gear selectivity. 	<ul style="list-style-type: none"> • European Maritime and Fisheries Fund (EMFF): One aim is to provide financial support to businesses and Member States to invest in new technologies and equipment for fishing with less impact, avoiding environmentally sensitive areas, to collect data on fish stocks, and put strong controls on fishing in place. • Horizon Europe
Zero pollution	7	<p>Zero plastic litter generation</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> • All plastics on the EU market is reusable or recyclable • All single-use plastics are banned worldwide <p><u>Checkpoints for 2025</u></p>	<ul style="list-style-type: none"> • The Marine Strategy Framework Directive includes marine litter as one of the 11 descriptors of the Good Environmental Status (GES). Together with the regional sea conventions, MSFD implementation has improved the monitoring and knowledge on marine litter, triggering new legislation to curb single-use plastics and 	<ul style="list-style-type: none"> • Horizon Europe, incl. proposed European Partnerships 'Circular Bio-Based Europe' and 'Partnership for Assessment of Chemical Risks' (PARC), 'Water4All', 'A climate neutral, sustainable and productive Blue Economy'

	<ul style="list-style-type: none"> • The EU has launched a zero plastics-pollution pilot in the Mediterranean Sea and its main river catchments • The EU has banned all single-use plastics and intentionally added micro-plastics • All fishing gears are equipped with geo-positioning detectors 	<p>lost fishing gear, which account for some 70 percent of all beach litter.</p> <ul style="list-style-type: none"> • The EU Strategy for Plastics in the Circular Economy has set in motion a comprehensive set of initiatives responding to a challenge of serious public concern. To support a global shift to a circular economy, the Commission is leading efforts at international level to reach a global agreement on plastics, and promote the uptake of the EU's circular economy approach on plastics. The new Circular economy Action Plan COM8 announces further targeted measures to address the sustainability challenges posed by plastics, notably addressing the presence of microplastics in the environment, regulating bio-based, biodegradable and compostable plastics, and ensuring the timely implementation of the Directive on Single Use Plastic Products. A review of the Directive is planned for 2027. • Ongoing review of the Urban Wastewater Treatment Directive is tackling the issue of waste water treatment of micro-pollutants including micro-plastics. • Under the BLUEMED Initiative, the EU and non-EU countries bordering the Mediterranean Sea have launched a pilot for a healthy, litter free to promote the circulation of good practices, R&I actions but also demonstration, communication and educations actions. • European strategy for data: a pilot will be initiated for early implementation of the data strategy in the context of the 'zero pollution ambition' to harvest the potential of an 	<ul style="list-style-type: none"> • NextGenerationEU, including Recovery and Resilience Facility • Digital Europe, data spaces. • LIFE programme: priority area Environment and Resource Efficiency, implementation of waste legislation (sorting and value added recycling of plastics) • European Regional Development, support for investments in the water sector and in the waste sector • Cohesion Fund, support for investments in the water sector and in the waste sector
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		<p>already data-rich policy domain with data on chemicals and other hazardous substances in the sea, which can have direct benefits to the health of the ocean.</p>	
<p>8</p>	<p>Eutrophication of European seas and waters is halted</p> <p><u>By 2030</u></p> <ul style="list-style-type: none"> • Losses of nutrients into the environment are reduced by at least 50 percent and the use of fertilisers is reduced by at least 20 percent • Use and risk of chemical pesticides and the use of more hazardous pesticides is reduced by 50 percent • 100 percent of urban wastewater is subject to tertiary (advanced) treatment • All waste waters from ships operating in the European waters is delivered to treatment plants on land <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> • EU agricultural subsidies are subject to compliance with rate of use of inorganic and organic fertilisers, among other criteria. • 100 percent of urban wastewater in designated coastal areas is subject to tertiary (advanced) treatment 	<ul style="list-style-type: none"> • The EU policy framework on nutrient pollution and sustainable nutrient management is composed of the Urban Wastewater Treatment Directive (UWWTD), the Nitrates Directives (NiD), the Sewage Sludge Directive, the Water Framework Directive (WFD), the National Emission Ceilings Directive (NECD), the Marine Strategy Framework Directives (MSFD), the Industrial Emissions Directive (IED) and the Fertilizing Products Regulation. The CAP also includes the respect of certain provisions of some of these instruments in cross-compliance/eco-conditionality. • As mentioned in the Biodiversity Strategy and the Farm-to-Fork Strategy, the Commission will promote the goal of zero pollution from nitrogen and phosphorus flows from fertilisers through reducing nutrient losses by at least 50 percent, while ensuring that there is no deterioration in soil fertility. This will result in the reduction of use of fertilisers by at least 20 percent. This will be achieved by implementing and enforcing the relevant environmental and climate legislation in full, identifying with Member States the nutrient load reductions needed to achieve these goals, applying balanced fertilisation and sustainable nutrient management, and by managing nitrogen and phosphorus better throughout their lifecycle. To this end, the 	<ul style="list-style-type: none"> • Horizon Europe, incl. proposed European Partnership 'A climate neutral, sustainable and productive Blue Economy' • Common Agriculture Policy (future): direct payments types of interventions (basic income support for sustainability, schemes for climate and environment, sectoral types of interventions, rural development types of interventions (environmental, climate and other management commitments and knowledge and information). • LIFE programme: priority area Environment and Resource Efficiency (waste water treatment)

	<ul style="list-style-type: none"> • 100 percent of wastewater in rural areas is collected 	<p>Commission will work with Member States to develop an Integrated Nutrient Management Action Plan in 2022.</p> <ul style="list-style-type: none"> • Commission proposal for Regulation on support for CAP Strategic Plans (2018) provides for new measures for environment protection, among them schemes for climate and environment under the first pillar that would reward farmers for commitments going beyond statutory requirements and minimum standards. Also, under the second pillar, reinforced environmental and climate management commitments among others as regards the use of fertilisers and plant protection products. This proposal is currently under legislative procedure. 	
9	<p>Zero spill</p> <p><u>By 2030</u></p> <ul style="list-style-type: none"> • 50 percent of ships operating in the EU are granted the EU Green shipping label • Waste and container loss from the shipping sector operating in the EU is reduced by at least 75 percent • All ports have facilities to receive waste and wastewaters from ships • The release of micro-pollutants (pesticides, pharmaceuticals, biocides, PFASes) into wastewater 	<ul style="list-style-type: none"> • The Water Framework Directive lays down a strategy to fight against the pollution of water, including adopting specific measures against pollution by individual pollutants or groups of pollutants presenting a significant risk to or via the aquatic environment. Implementation of the Urban Wastewater Treatment or the Industrial Emissions Directives is key to reduce freshwater pollution, although the evaluation of the former pointed to some limitations of the waste water treatment plants that can be relevant for the marine environment, such as not addressing contaminants of emerging concern (e.g. pharmaceuticals and micro-plastics), or not treating all storm water, urban runoff or small agglomerations. • In the marine environment, recent implementation report of the Marine 	<ul style="list-style-type: none"> • Horizon Europe, incl. proposed European Partnership A climate neutral, sustainable and productive Blue Economy' • LIFE programme: priority area Environment and Resource Efficiency (waste water treatment).

		<p>treatment plants has been reduced by 50 percent</p> <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> • An EU Green shipping label is in place for ships operating in the EU rewarding high performance regarding invasive species, SOx, NOx, macroparticules, CO₂ emissions, waste, oil residues, underwater noise • Waste and container loss from the shipping sector operating in the EU is reduced by at least 50 percent • The access to European ports of vessels equipped with scrubbers (known as open loop systems) is prohibited • The runoff of micro-pollutants (pesticides, pharmaceuticals, biocides, PFASes) into water is reduced by 30 percent. • Dumping of red muds, mining residues and severely contaminated dredged sediments in rivers and seas is halted 	<p>Strategy Framework Directive shows that there is room for improving the monitoring of marine pollution through (i) more effective data mining and joint monitoring networks (especially in the Mediterranean and Black Seas), and (ii) harmonised methodological approaches at a regional scale.</p> <ul style="list-style-type: none"> • As part of the Commission’s Zero Pollution Ambition for a toxic-free environment, a new EU Chemicals Strategy for Sustainability will be put forward along with a Zero Pollution Action Plan for Air, Water and Soil. Globally, ships pollution is regulated by the IMO through the International Convention for the Prevention of Pollution from Ships (MARPOL). At EU level, the legislation addressing sulphur oxides emissions from shipping in the EU is Directive (EU) 2016/802 regulating the sulphur content of certain liquid fuels. • The EU Directive on port reception facilities for ship-generated waste and cargo residues, also aligns with the MARPOL Convention, and aims to reduce pollution from the waste produced by ships. 	
	10	<p>Underwater noise is regulated and reduced</p> <p><u>By 2030</u></p>	<ul style="list-style-type: none"> • Work is ongoing under the Marine Strategy Framework Directive (GES Descriptor 11) to develop noise monitoring and assessment of pressures and their impact on the marine environment, which has already enabled 	<ul style="list-style-type: none"> • Horizon Europe, incl. proposed European Partnership ‘Zero-Emission Waterborne Transport’ • European Regional

		<ul style="list-style-type: none"> Underwater acoustic emissions are reduced by at least 50 percent Noise impact mitigation measures have been defined in each European marine region and continental sub-aquatic environment <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> Compulsory regulation on underwater noise from all sources is enacted 30 percent less underwater noise from shipping 	<p>developing underwater noise monitoring surveys and to establish a number of registers for impulsive underwater sound. While some underwater noise maps are available, status assessments are still very scarce.</p>	<p>Development, supports investments to develop and improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links</p> <ul style="list-style-type: none"> Cohesion Fund, supports investments to develop and improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links.
<p>Decarbonising the activities in our ocean, seas and waters</p>	<p>11</p>	<p>Climate-neutral waterborne transport</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> 100 percent of propulsion engines of leisure boats, fishing vessels and ferries and other short-sea shipping are converted to non-fossil propulsion CO₂ emissions from the shipping sector operating in the EU are reduced by 45 percent 	<ul style="list-style-type: none"> The European Green Deal aims at increasing the EU's climate ambition for 2030 and 2050. It will accelerate and underpin the transition needed in all sectors. It will include the revision of all relevant climate-related policy instruments. On maritime, it includes a basket of measures to reduce maritime transport emissions and ensure its fair contribution to the climate effort. Fuel EU Maritime initiative is part of the Commission Work Programme 2020 - Ship traffic to or from ports in the EEA accounts for some 11 percent of all EU CO₂ emissions from transport and 3-4 percent of total EU CO₂ emissions. This initiative aims at reducing emissions from maritime transport by 	<ul style="list-style-type: none"> Connecting Europe Facility: <ul style="list-style-type: none"> Investments in green shipping: in the current MFF, under CEF blending and CEF debt instruments, alternative fuels vessels and related infrastructures and innovative companies involved in green shipping can be co-financed. For the future MFF this is to be reflected for the

	<ul style="list-style-type: none"> • 50 percent of vessels older than 20 years are dismantled and recycled in Europe • 100 percent of European ports are carbon-neutral and provide electricity at berth. <p><u>Checkpoints for 2025</u></p> <ul style="list-style-type: none"> • 50 percent of propulsion engines for ferries and other short-sea shipping are converted to non-fossil propulsion • CO₂ emissions from the shipping sector operating in the EU are reduced by 30 percent • 20 percent of vessels older than 20 years are dismantled and recycled in Europe • 30 percent of ports provide electricity at berth for ferries, cruises and any kind of ships 	<p>accelerating the uptake of sustainable alternative fuels and power in operation and at berth. Ensuring a much more diverse fuel mix and a higher penetration of sustainable alternative fuels is critical to bring maritime transport in line with the European ambition of climate-neutrality by 2050.</p> <ul style="list-style-type: none"> • Strategy for sustainable and smart mobility, which will be published in 2020 and set the framework for EU measures on the matter. Some key areas of intervention in the maritime sector concern ramping-up the production, deployment and uptake of sustainable alternative transport fuels, regulating access of the most polluting ships to EU ports and obliging docked ships to use shore-side electricity. • A revision of the Energy Taxation Directive along with a proposal to extend European emissions trading to the maritime sector are also amongst the measures proposed for 2021 addressing the call for the price of transport to reflect the impact it has on the environment. • Regulation on ship recycling aims to reduce the negative impacts linked to the recycling of ships flying the flag of Member States of the Union. The Regulation lays down requirements that ships and recycling facilities have to fulfil in order to make sure that ship recycling takes place in an environment sound and safe manner. From 31 December 2018, large commercial seagoing vessels flying the flag of an EU Member State may be recycled only in safe and sound ship recycling facilities 	<p>development of financial and blending products, notably under Invest EU.</p> <ul style="list-style-type: none"> ○ Investments in green ports: under CEF alternative fuel infrastructure can be co-financed. <p>The EMFF supports the rolling out of novel technologies and innovative products, processes and services in the field of marine and maritime policy.</p> <ul style="list-style-type: none"> • Horizon Europe, incl. proposed 'European partnership Zero-Emission Waterborne transport' • NAIADES programme 2021 for Inland waterway transport • LIFE programme financing environmental and climate objectives • COSME, the programme for Competitiveness of small and medium-sized enterprises supports SMEs, through a loan guarantee facility, helping business hit by the impact of the sanitary crisis. • The SME Window of the InvestEU fund will facilitate SME investment in sustainability and digitalisation.
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		<p>included in the European List of ship recycling facilities (https://ec.europa.eu/environment/waste/ships/list.htm). The Regulation brings forward the requirements of the 2009 Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships, therefore contributing to its global entry into force. The Regulation also includes additional safety and environmental requirements, as authorised by Article 1(2) of the Convention. The Hong Kong Convention has not entered into force.</p> <ul style="list-style-type: none"> • Support air quality policy: Directive on requirements relating to gaseous and particulate pollutant emission limits and type-approval for internal combustion engines for non-road mobile machinery. 	<ul style="list-style-type: none"> • BlueInvest combining for the first time in the maritime sector EU grants with equity and providing SMEs with investment readiness assistance targeted to their specific needs, with access to finance for their innovation projects and with visibility to the investment community, matching entrepreneurs with investors. • More than 40 regions across Europe have identified maritime sectors/activity areas in their smart specialisation strategies. They are mainly implemented with support from ERDF and other ESIF funds, national and regional funds as well as leveraging private financial investment. • European Regional Development supports investments to develop and improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links • Cohesion Fund supports investments to develop and
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			<p>improving environmentally-friendly (including low-noise) and low-carbon transport systems, including inland waterways and maritime transport, ports, multimodal links</p> <ul style="list-style-type: none"> • EU Taxonomy to help investors, companies, issuers and project promoters navigate the transition to a low-carbon, resilient and resource-efficient economy • The Innovation fund is a key funding instruments for delivering the EU's economy-wide commitments under the Paris Agreement and its objective to be climate neutral Europe by 2050, as recognised also in the European Green Deal Investment Plan. • The Modernisation fund is a dedicated funding programme to support 10 lower-income EU Member States in their transition to climate neutrality by helping to modernise their energy systems and improve energy efficiency.
	<p>12 Support the energy transition through renewable, low-impact ocean energy</p> <p><u>By 2030:</u></p>	<ul style="list-style-type: none"> • Offshore Energy Strategy, foreseen for autumn 2020. This strategy will focus on offshore energy as a key contributor to the EU energy and climate goals, and will identify actions to step up investments in offshore 	<ul style="list-style-type: none"> • Connecting Europe Facility • Horizon Europe • The EMFF supports the rolling out of novel technologies and innovative products, processes

	<ul style="list-style-type: none"> At least 35 percent of the EU energy mix is covered by clean, low-impact, renewable ocean energy (wind, wave, tidal, thermal and salinity gradient energy) <p><u>Checkpoint for 2025:</u></p> <ul style="list-style-type: none"> Coastal energy production from low-impact offshore renewable energy has increased by 200 percent 80 percent of the whole energy consumption of the islands is coming from renewables No new offshore drilling for oil and gas is authorised 	<p>energy in the EU's sea and ocean areas, in offshore wind but also other sources of energy such as wave and tidal energy.</p>	<p>and services in the field of marine and maritime policy.</p> <ul style="list-style-type: none"> LIFE+ Progamme COSME Innovation Fund ESIF NextGenerationEU, incl. Recovery and Resilience Facility InvestEU Renewable Energy Financing mechanism
13	<p>Zero-carbon aquaculture</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> The consumption of low trophic aquaculture (e.g. algae, shellfish, other invertebrates) from European waters, and seas has increased by 70 percent <p><u>Checkpoints for 2025:</u></p> <ul style="list-style-type: none"> The production of low trophic aquaculture has increased by 100 percent for algae and 20 percent for 	<ul style="list-style-type: none"> The Common Fisheries Policy (CFP) aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable and that they provide a source of healthy food for EU citizens. The Farm-to-Fork Strategy calls for a significant increase in organic aquaculture production. New Commission Strategic Guidelines for the sustainable development of EU aquaculture are to be adopted this year 	<ul style="list-style-type: none"> Horizon Europe, incl. proposed European partnership 'A climate neutral, sustainable and productive Blue Economy' The EMFF supports the rolling out of novel technologies and innovative products, processes and services in the field of marine and maritime policy.

	<p>shellfish and other invertebrates</p> <ul style="list-style-type: none"> The use of raw materials from sustainable aquaculture for other purposes has increased by 50 percent. 		
14	<p>A thriving blue biotech</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> The EU is the world leader in blue biotech. The market value of Blue Biotech has reached 200 billion euros <p><u>Checkpoints for 2025:</u></p> <ul style="list-style-type: none"> An EU programme for blue biotech development includes funding for venture capital and national programmes for blue biotech start-ups' ideation and acceleration. 		<ul style="list-style-type: none"> The EMFF supports the rolling out of novel technologies and innovative products, processes and services in the field of marine and maritime policy. Horizon Europe European partnership 'A climate neutral, sustainable and productive Blue Economy' InvestEU
15	<p>Climate-neutral blue tourism</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> 100 percent of marinas are carbon-neutral and provide electricity at berth 50 percent of tourism resorts and accommodation are converted to low CO₂ emission and low CO₂ 	<ul style="list-style-type: none"> European Agenda for Tourism 2050: This initiative was announced in the Commission Communication on Tourism and transport (13.5.2020). The Communication also announced that the European Commission will organise the European Tourism Convention, which will gather stakeholders to discuss the European tourism of tomorrow. This Convention is scheduled for 12 October 2020 and should gather concrete ideas that would 	<ul style="list-style-type: none"> Sustainable, innovative and resilient coastal tourism could be supported under the future Single Market Programme by boosting the competitiveness and capacities of tourism businesses, in particular the SMEs The EMFF supports the rolling out of novel technologies and

		<p>consumption</p> <p><u>Checkpoints for 2025:</u></p> <ul style="list-style-type: none"> Blue belts of green transport infrastructures for connection of coastal areas through EU waterways are designated and funded 	<p>feed in the development of a roadmap for the sustainable, innovative and resilient European tourism ecosystem (the future European Agenda for Tourism 2050).</p>	<p>innovative products, processes and services in the field of marine and maritime policy.</p>
Revamping governance	16	<p>An integrated and participatory EU-system of ocean and water governance</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> A European Ocean and Water Agency is fully established <p><u>Checkpoints for 2025:</u></p> <ul style="list-style-type: none"> The legislation creating the European Ocean and Water Agency is enacted In 2022, the European Commission presents the first Integrated Ocean and Water Plan for Europe 2022-2030 and in 2025, its first triennial report The European Council convenes the first EU Ocean and Water Summit 	<ul style="list-style-type: none"> Council Regulation establishing the European Environment Agency (EEA) and the European Information and Observation Network (EIONET) Regulation establishing a European Maritime Safety Agency (EMSA) Council Regulation establishing a European Fisheries Control Agency (EFCA) Directive establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive, MSFD) Regulation on the Common Fisheries Policy (CFP Regulation) (11 December 2013) Water Framework Directive establishes a framework for protection of inland surface waters, transitional waters, coastal waters and groundwater. The fitness check of Water Framework Directive, Groundwater Directive and Floods Directive was carried out in 2019 (SWD(2019)439). 10th Commission Report on the implementation of Urban Waste Water Directive (10/09/2020) and initiative to update EU rules on urban waste water 	

			treatment (planned for first quarter of 2021)	
			•	
	17	<p>EU leadership for effective global ocean governance</p> <p><u>By 2030:</u></p> <ul style="list-style-type: none"> • IUU fishing is eradicated globally [UN] • International ban on all activities causing seabed habitat loss and degradation takes effect [UN] • International UN agreement on protection and management of major rivers is concluded and all major rivers of the globe have an internationally supported management plan and national/international commission (EU sponsored set-up and is member of boards of key rivers linked to EU territories, such as Nile, Amazonia, Congo) • New international standards for harbours, ports and shipping are enacted [IMO] • All EU bilateral trade agreements condition market access to elimination of IUU fishing and fulfilment of international fisheries agreements • All maritime surveillance activities of EU agencies and Member States are 	<ul style="list-style-type: none"> • The International Ocean Governance Agenda for the future of our oceans promotes an effective and coherent EU contribution towards healthy, clean, secure, safe and sustainably managed oceans. The agenda is an integral part of the EU's response to the 2030 Agenda and contributes to the European Green Deal. It identifies 50 actions to improve the international framework, reduce pressures, facilitate a sustainable blue economy, and strengthen international ocean research and data. 	<ul style="list-style-type: none"> • Draft EMFF 2021-2027: Article 45 of the current draft EMFF Regulation for the period 2021/2027 regulates the budget for the IOG. • Horizon Europe Foreign Policy Instruments funding for ocean governance (e.g. EU-China Action on Marine Data, MPA action in SEA and Asia, EU Action on Black Carbon in the Arctic), • Neighbourhood, Development and International Cooperation Instrument (NDICI): Oceans are amongst the key global challenges to address. Support to oceans is ensured in the four pillars of this Instrument. • Pre-accession Assistance (IPA III): Fisheries as well as the conservation and sustainable management of marine ecosystems are included as thematic priorities for assistance. • Free Trade Agreements with third countries, in particular in the Mediterranean and Balkans.

coordinated and joint surveillance operations in EU and international waters are carried out

Checkpoints for 2025:

- A robust UN Agreement on areas beyond national jurisdiction (BBNJ) is ratified [UN]
- International ban on all activities causing seabed habitat loss and degradation is enacted [UN]
- All harmful fisheries subsidies have been eliminated, including fuel and new vessel construction subsidies [WTO]
- The EU has identified where international standards for harbours, ports and shipping are missing and leads global efforts for their adoption [IMO]
- The EU has concluded ocean governance agreements with all strategic partners (China, USA, Canada, Japan, South-Korea)
- The EU supports regional ocean governance as part of its partnership and cooperation agreements in Africa, the Pacific and the Caribbean, as well as in South-East Asia and the Indian Ocean

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| | <ul style="list-style-type: none">• The EU has concluded circular economy agreements with Mediterranean riparian countries to ban, reuse and recycle plastics• European maritime surveillance data is streamlined: all data collected by EU Member States and EU agencies on all activities at sea is pooled centrally and made accessible to all coastguards' functions at national and EU level. | |
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In this report, the Mission Board on Healthy Oceans, Seas, Coastal and Inland Waters proposes a Mission Starfish 2030: Restore our Ocean and Waters by 2030.

Inspired by the shape of the starfish, the Mission has five overarching objectives for 2030: (i) Filling the knowledge and emotional gap, (ii) regenerating marine and freshwater ecosystems, (iii) zero pollution, (iv) decarbonising our ocean, and waters (v) revamping governance. These five objectives are mutually supportive and taken together, the Mission Starfish 2030 will enable the restoration of the water cycle as a whole.

For each of the five objectives, a set of ambitious, concrete and measurable targets has been defined. They specifically address the actors, activities, tools and systems that all need to be called upon to reach each objective. These targets are considered the indispensable components of a holistic approach to systemic change.

Studies and reports

