BRIEFING

European Parliament

EU climate action in ocean governance and fisheries policy

SUMMARY

Marine resources are a vital and growing source of food for human consumption, while oceans also play an important role in climate regulation. Scientific evidence shows that the climate system has changed rapidly in recent decades, with the oceans greatly mitigating the effects of climate change by absorbing excess heat and human-made carbon emissions. The velocity of the effects of climate change leaves little room for adaptation, causing both declines in abundance and geographic shifts in fish populations. As a result, people who rely heavily on seafood and fisheries for their livelihoods run the risk of income loss and food insecurity.

The European Green Deal places climate action at the heart of a wide range of new legislative and non-legislative initiatives and includes ambitious goals such as achieving climate-neutrality by 2050 and preserving and protecting biodiversity. The new 'farm to fork' strategy addresses the challenges of sustainability in the food supply chain and, in the area of seafood, highlights the imminent update of the strategic guidelines on aquaculture, the goal to support the algae industry and the focus on climate change in the 2022 common fisheries policy review. In its biodiversity strategy, the Commission proposes a new binding target of 30 % marine protected areas in EU waters by 2030, a target supported by Parliament.

A reduction in fishing pressure could also offset the environmental impacts of climate change. The last reform of the common fisheries policy marked an important milestone by requiring fish stocks to be restored and maintained above levels capable of producing the maximum sustainable yield. An own-initiative report from Parliament's Committee on Fisheries focuses specifically on the impact of rising seawater temperatures on fish stocks and fisheries. The oceans can be harnessed to help to close the emissions gap however, by unlocking their renewable offshore energy potential. In its offshore renewable energy strategy, the Commission aims to reach a deployment of 300 GW in offshore wind capacity by 2050, a 20-fold increase compared to today. Another own-initiative report from Parliament's Committee on Fisheries looks into the impact on the fishing sector of offshore wind and other renewable energy systems.

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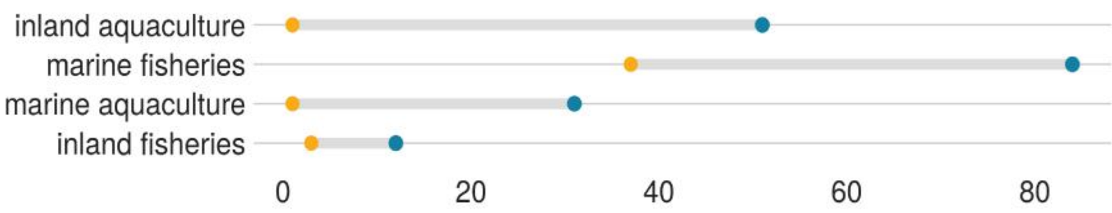
Background

Oceans and seafood production

Marine resources constitute a vital and growing source of food for human consumption. Primary producers, such as phytoplankton and seaweed, are the basic food source for all ocean life. They support the existence of ecosystems, such as coral reefs and seagrass meadows, which provide habitats for many other species, such as molluscs, crustaceans and fish. The latest United Nations (UN) Food and Agriculture Organization (FAO) report on fisheries and aquaculture (SOFIA 2020) highlights the important and growing role of fisheries and aquaculture in providing nutrition and employment. From 1961 to 2018, global fishery and aquaculture production increased from 42 million tonnes to 179 million tonnes (see Figure 1). Of the global production in 2018, 156 million tonnes was intended for human consumption, which corresponds to an annual consumption of 20.5 kg per capita, compared with 9.0 kg in 1961. According to the European Market Observatory for Fisheries and Aquaculture (EUMOFA), EU citizens consume above the global average, eating about 24 kg of seafood per capita in 2018. In the 1961-2017 period, the average annual growth in the volume of fish produced for human consumption reached 3.2 %, exceeding both the annual growth of the population (1.6 %) and the growth of all other animal proteins (meat, eggs, milk, etc., 2.1 %). In 2017, fish consumption represented 17 % of the animal protein intake of the world's population and 7 % of all protein consumed.

Figure 1 – Increase in global fishery and aquaculture production (1961 - 2018, in million tonnes)



Data source: FAO report on fisheries and aquaculture (SOFIA report - interactive story, Figure 1).

Globally, in 2018, about 60 million people were involved in primary fisheries and aquaculture production, mostly in developing countries. The majority are small-scale, artisanal fishermen and aquaculture workers. In the EU, around 225 000 people are employed in primary production, namely 146 906 in fisheries (2018 data) and about 75 000 in aquaculture (2016 data). Also taking into account the fish processing and distribution sectors, the Commission estimates in its 2020 blue economy report that in 2018 around 573 300 people are employed in the living marine resources sector of the EU.[1] However, the EU's importance in the trade of such products is significantly greater, as it is the largest single import market for fisheries and aquaculture products in the world. The above figures on production and employment do not include the algae sector. According to the Commission's blue economy report, biomass production of algae is increasing worldwide, reaching 33 million tonnes in 2016 (globally mainly from cultivated production, but in the EU mainly from wild harvest). It is used for a wide variety of non-food products such as cosmetics, pharmaceuticals and bio-energy, but edible seaweed is also widely used in Asia as food and is gaining popularity in Western diets.

Oceans and climate regulation

Oceans are not only an important food source, they also play a major role in oxygen production and climate regulation. Scientists estimate that about half of the total oxygen in our atmosphere comes from marine photo synthesisers, such as phytoplankton. They absorb carbon dioxide (CO_2), water and energy from sunlight, and thereby release oxygen. In addition, the so-called 'biological ocean carbon pump' transports about 10 billion tonnes of organic carbon, e.g. from dead phytoplankton, from near surface water to the deeper layers of the ocean. Thanks to the removal of CO_2 from the atmosphere and the sinking of carbon particles from near surface water to the deep waters – after which it may get buried in the underlying sediments or remineralised and consumed by other marine life – the ocean carbon cycle is one of the most important climate regulators. In addition, coastal ecosystems such as mangroves, salt marshes and sea grasses also play a critical role in carbon storage. Per unit area they capture carbon faster and more efficiently than forests. Oceans also have a great capacity to store and release heat and thereby mask and slow surface warming. Ocean circulation and mixing redistribute heat over great distances and depths, from the tropics to polar regions and from the surface to the deeper layers.

Climate change impacts on oceans and fisheries

Scale and physical impact

The Intergovernmental Panel on Climate Change (IPCC)[2] produces both a series of global climate change assessment reports and special reports on specific topics. In its latest assessment report, the IPCC stated that the earth is warming at an unprecedented rate and scale, with greenhouse gas (GHG) emissions from human activity the dominant cause of the observed warming.[3] It observed that each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. More recently, the UN World Meteorological Organization (WMO), noted that 2011 to 2020 was the hottest decade on record, with the 2020 mean global temperature already 1.2 °C above pre-industrial levels. The Arctic region has been warming much faster than the global average, as has Europe. Data from the EU's Copernicus Climate Change Service revealed that 2020 was Europe's warmest year recorded, standing out for its exceptional warmth in the Arctic and a record number of tropical storms in the North Atlantic. According to the 2020 UN emissions gap report, taking into account commitments in the current climate action plans and despite a brief dip in carbon dioxide emissions caused by the Covid-19 pandemic, the world is heading for 3 °C in global warming by the end of the century.

In September 2019, the IPCC issued a special report on **oceans and cryosphere** (SROCC), which was also presented to the Parliament's Committee on Fisheries (PECH). It noted that the oceans literally took the heat from global warming by absorbing more than 90 % of the excess heat in the climate system. The rate of **ocean warming** has doubled since 1993. By 2100, oceans would take up another two to four times more heat if global warming is limited to 2 °C and up to five or seven times at higher emissions. As a consequence of air and ocean warming, **marine heatwaves** are increasing in frequency, duration, spatial extent and intensity. Climate models project a 10-fold increase in intensity under an unabated emissions scenario. The warming of ocean water affects the **oxygen level**, especially in the upper 1000 metres. Warmer water retains less oxygen and also increases the oxygen demand of living organisms. Ocean warming also decreases inter-layer mixing and affects the supply of oxygen. As a result there is an oxygen loss in the upper layer, alongside an expansion in volume of the oxygen minimum zones. In addition, algal blooms due to eutrophication (caused in part by nutrient pollution from agriculture) contribute to the problem of deoxygenation and thereby aggravate the situation, especially in coastal waters. The Marine Messages II report from the European Environment Agency (EEA) points to problem of permanent and seasonal oxygen depletion in the Baltic Sea and Black Sea.[4]

The melting of glaciers and ice-sheets, in particular of Greenland and the Antarctic, is the dominant cause of **sea-level rise**. In combination with thermal expansion due to ocean warming, this could lead to a global sea-level rise that, according to the SROCC report, could reach 43 cm by 2100 and almost 1 metre by 2300 in a strong mitigation scenario. In the case of unabated emissions, the global mean sea-level rise might even be more than 3 metres by 2300. Arctic ice is declining and getting thinner as well. With global warming of 2 °C, the **Arctic Ocean** could potentially become free of sea ice in September once every three years.

By absorbing human-induced carbon emissions, marine water contains more dissolved carbon, causing **acidification**. The SROCC estimates that the oceans have already taken up some 20 to 30 % of those emissions since the 1980s and continued carbon uptake will only exacerbate the situation. The open ocean surface pH is projected to decrease by around 0.3 pH units by 2100, relative to the 2006-2015 period, under an unabated emissions scenario.

As illustrated in the SROCC, the above mentioned physical and chemical impacts are stabilised in a 'low GHG emission – strong mitigation' scenario (leading to a global warming of about +1.6 °C by 2100) as compared to the 'high GHG emission – lack of climate action' scenario (+4.3 °C by 2100).

Impact on marine life and fisheries

The effects of climate change on oceans pose a serious threat to marine life, with wider impacts on marine ecosystems and on communities depending on them. Ocean warming and acidification, and the reinforcing effect of the combination of both factors, are the driving forces of change.

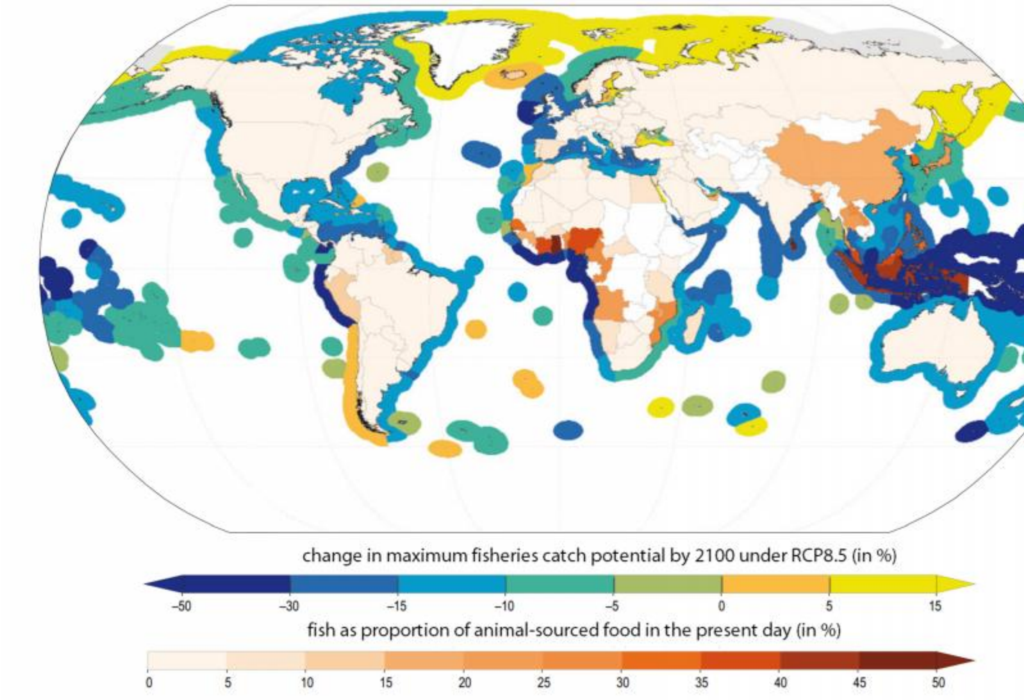
Warm water coral reefs are identified by the IPCC as the most vulnerable marine ecosystem in relation to the impacts of climate change. They are particularly vulnerable to marine heat waves, as they can suffer high mortalities if water temperatures remain above a threshold of 1 °C to 2 °C over the normal range. Such conditions have already occurred in many tropical seas and resulted in extensive coral bleaching. Future reef degradation will lead to a loss of the marine life that depends on it. This poses a threat to small-scale fisheries in the lower latitude zones in particular, and concerns developing countries in the main. Even in a scenario of 1.5 °C global warming there is a high risk of losing 70 to 90 % of coral reefs and associated services for humankind. Reefs are also exposed to other increased impacts, such as enhanced storm intensity. Recovery of coral reefs is slow and few coral reef areas show any resilience to global change drivers. Variations in exposure, sensitivity and adaptive capacity between coral populations and regions could lead to major changes in the composition and structure of the remaining warm water coral reefs. The IPCC risk assessment for marine ecosystems shows that all **other ecosystems** (cold water coral reefs, kelp forests, seagrass meadows, etc.) will fall outside the high-risk zones if, thanks to successful climate policies, global warming is limited to less than 2 °C above pre-industrial levels.

At the current pace of climate change impacts, **fish stocks** have little time to adapt; the result is geographical shifts and loss of ocean biodiversity. Overall there is both a poleward shift and a decline in marine animal biomass. Maps from the IPCC report illustrate strong differences in the projected biomass change in the IPCC low and high emission scenarios. Those predictions do not take into account the complexity of the temperature limits of the different life stages between species (in particular the limited temperature range for spawning sites),[5] the interaction between species, and the level of carbon dioxide and oxygen deficiency, all of which can amplify the trend.

The change in biomass is reflected in redistribution and a **loss of fisheries catch potential**. Models predict a decrease in catch potential in the low-emission scenario of up to 6.4 % by the end of the century, while the expected loss in the high-emission scenario would be up to almost a quarter, with even a decrease of more than 50 % in some regions by 2100. Tropical oceans would be most negatively impacted, with a three-fold or greater decrease in catch potential compared with the global average, in particular in the western central Pacific Ocean, eastern central Atlantic Ocean and the western Indian Ocean. This will affect many populations in low-latitude regions, such as in the Pacific Islands and West Africa, that are already facing food insecurity challenges (see Figure 2).

Overall, the combined impacts of climate change on coral reefs and fish stocks are expected to affect **small-scale coastal fisheries** the most, with catches decreasing by up to 20 % by 2050, and by up to 50 % by 2100, under the high emission scenario. **Aquaculture** will also be affected, as two-thirds of the food for farmed fish originates from wild catches, while ocean acidification and increasing temperatures also threaten marine aquaculture directly (including an increased risk of disease). An increase in fishing productivity, on the other hand, would be limited to the Poles, in particular the **Arctic Ocean**, and some other locations.

Figure 2 – Projected changes in fisheries catch potential (colour scale in waters) under the high emission scenario and fish as proportion of animal-sourced food (colour scale on land)



Source: 2019 IPCC report on oceans and cryosphere (SROCC, Chapter 5, Figure 5.21).

In addition, following the **sea-level rise**, coastal areas will be exposed to a higher risk of extreme sea-level events and flooding (e.g. due to storm surges). Maps from the EEA illustrating the projected frequency change in historical once-a-century coastal flooding events by 2100, show high impacts in the EU on the Atlantic and western Mediterranean coasts. Globally, **Arctic communities** and **small urban islands** might be faced with adaptation limits, and ultimately land loss, in a high-emission scenario. The impacts of sea-level rise on coastal ecosystems include habitat contraction, loss of functionality and biodiversity. This will also affect the local fishing communities and their activities.

The impacts of climate change and extreme weather events depend on the region and latitude and affect not only fish production but the **entire value chain**, with effects on prices, trade and consumption. A 2018 FAO report described the impacts of climate change on fisheries and aquaculture, including an analysis by region.[6] For example, it indicated that the centres of distribution for a broad range of North Sea fish species shifted by distances ranging from 48 km to 403 km between the 1970s and early 2000s and that various models for 14 commercial fish in the north-east Atlantic predict poleward shifts for the next decades at an average rate of 27 km per decade. Species may also migrate across political or management boundaries, which can generate conflict in the **allocation of quotas**. A recent example arose with regard to quota allocations for mackerel between the EU, Norway, Iceland and the Faroe Islands. The latter two, notably Iceland, had unilaterally increased their quotas for this stock due to its sudden abundance in their territorial waters. Long-term climate change can make stocks more vulnerable to fishing. For example, in the case of North Sea cod, rises in temperature since 1980 are estimated to have eroded the **maximum sustainable yield** (MSY)[7] by 32 000 tonnes per decade. Calculations show that a sustainable North Sea cod fishery under a warmer climate is still possible but only at a lower level of fishing. The FAO report also noted the strong combination of additional stressors (e.g. overfishing, pollution, habitat degradation, demographic increase and increased tourism) in several regions of the Mediterranean and Black Sea, all of which increases vulnerability and decreases the capacity to provide for effective climate change mitigation. Warming is expected to lead to the 'tropicalisation' (the expansion of non-native tropical species) in the Mediterranean and the 'Mediterranisation' (the spread of Mediterranean species) in the Black Sea. The arrival of non-indigenous species however will trigger problems in fisheries that are based on **native species**. In a risk analysis assessing the vulnerability to climate change of marine fish, fishing fleets and fishery-dependent communities, the EU-funded research project CERES listed coastal regions in Romania, Bulgaria and along the southern Baltic coast as those EU regions at greatest risk.[8] Globally, the **economic implications** of climate change on fisheries will vary widely between regions and countries because of the differences in exposure and adaptive capacity. Overall, regions with the highest exposure and economic vulnerability to climate change are also often those with the lowest capacity to adapt, with serious implications for jobs and food security.

Climate action in ocean and fisheries policy

Global awareness

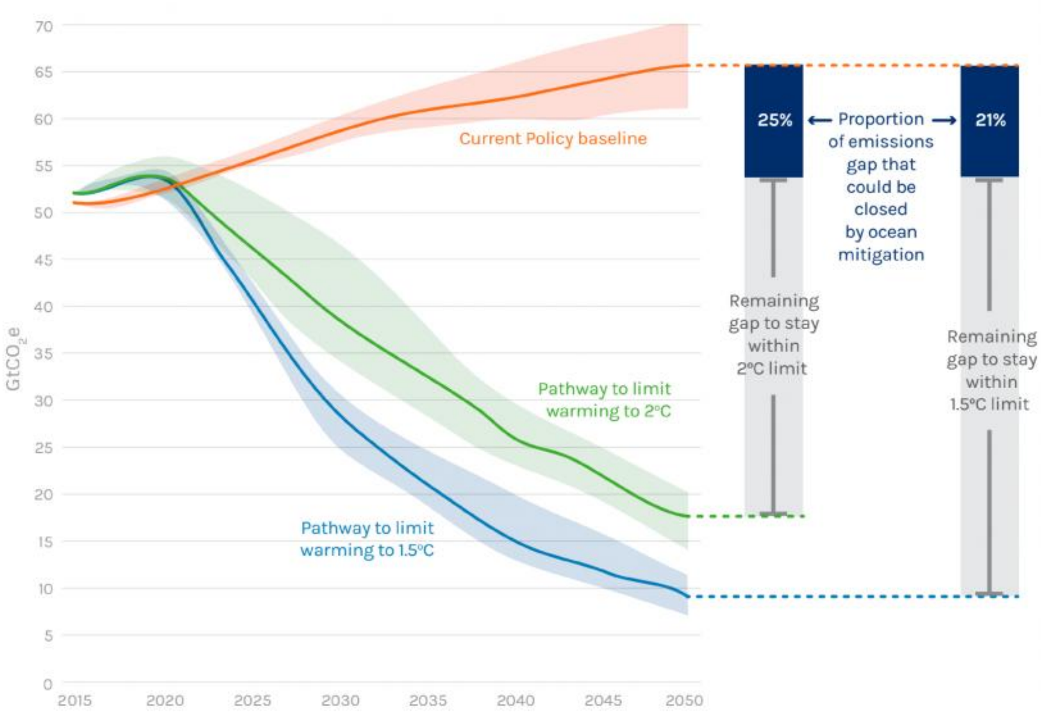
Global awareness of climate change impacts and the need to reduce GHG emissions led to a series of UN climate change conferences.[9] The third, held in Kyoto in 1997, produced the Kyoto Protocol which entered into force in 2005 and committed developed countries to a quantified reduction of their collective carbon emissions. As a number of developing countries experienced great economic growth and became major emitters of GHGs, a new international agreement was negotiated and adopted at the 21st conference in 2015 in Paris. The Paris Agreement has been ratified by 196 countries and aims to maintain the increase in global temperatures well below 2 °C above pre-industrial levels, while pursuing efforts to limit the increase to 1.5 °C. Since the adoption of the agreement, there has been growing awareness that climate change is the greatest challenge of this century. The next conference is scheduled to be held in November 2021 in Glasgow and will focus on implementation aspects, including the national determined contributions (NDCs).

The important role of oceans in supporting life on the planet, including their role as climate regulators, is also recognised by the annual international 'Our Ocean' conferences, launched in 2014 in response to the widespread deterioration of the marine environment. The latest conference took place in Oslo in October 2019, with climate change as one of six areas of action. Climate change action and the sustainable use of oceans are also among the 17 UN sustainable development goals, adopted by all UN Member States in 2015 as part of the 2030 Agenda for Sustainable Development.

Solutions and the role of oceans

Despite being the victims of climate change, oceans are also a powerful source of solutions for achieving the goals of the Paris Agreement. The high-level panel for a sustainable ocean economy, set up in 2018 and supported by the UN Secretary-General's Special Envoy for the Ocean, represents 14 highly diverse nations, large and small, across all ocean basins. One of its special reports 'The Ocean as a Solution for Climate Change: Five Opportunities for Action', offers detailed analysis of the oceans' potential to help close the emissions gap in 2030 and 2050. The solutions explored are **marine renewable energy** (including offshore wind, wave, tidal and floating solar), the use of **low- and zero-carbon fuels in marine transport** (such as hydrogen, ammonia and some biofuels), the protection of **coastal and marine ecosystems** (with benefits of carbon uptake and storage, coastal protection and increased fish productivity), the stimulation of **sustainability in fisheries and aquaculture production** (by reducing emissions in fisheries, by replacing feed in aquaculture, and by increasing the share of ocean-based protein in human diets, as it is far less carbon-intensive than land-based proteins) and **carbon storage in the seabed** (which has enormous theoretical potential, but also faces significant technical and socio-economic challenges – including environmental ones). Figure 3 illustrates the potential contribution of these five ocean-based solutions, namely closing the emission gap by up to one quarter by 2050 in a 2 °C global warming scenario. Ocean renewable energy in particular would account for almost half of that effort.

Figure 3 – Contribution of ocean-based solutions to close the emissions gap



Source: The Ocean as a Solution to Climate Change (High level panel for a sustainable ocean economy).

On the protection of coastal and marine ecosystems, the establishment of **marine protected areas** (MPAs), geographically distinct zones for which conservation objectives are set, is an important tool in enhancing resilience against climate change for different reasons. They enhance the production of fish stocks (with spill-over effects to surrounding areas), improve the ability of marine organisms to adapt (as areas of reduced stress) and allow increased carbon uptake. In addition, well-integrated networks of MPAs can increase species survival by allowing them to migrate from one area to another, thereby facilitating the poleward movement of species. Internationally, the Aichi biodiversity targets, under the UN Convention on Biological Diversity, set a target to identify and effectively manage 10 % of coastal and marine areas by 2020 as MPAs, especially areas of particular interest to biodiversity and ecosystem services that are ecologically representative. More recently, international organisations have been calling for a global 30 % MPA target by 2030. Furthermore, local **marine habitat restoration** measures, such as assistance to species in relocation and coral gardening can be effective but mainly in a low emission – strong mitigation scenario.

As regards **sea-level rise**, various adaptation approaches are being implemented. The building of hard walls or dykes however constrain coastal habitats which may also be spawning sites. **Ecosystem-based adaptation** is the most beneficial because it maintains or restores the coastal ecosystem, benefiting biodiversity and coastal carbon storage.

In **fisheries**, the degradation of marine ecosystems and an overall decline in and redistribution of catch potential is a challenge for fisheries management. Strengthening precautionary measures, such as rebuilding overexploited or depleted fisheries, and improving the responsiveness of existing fisheries management strategies, are ways to reduce negative climate change impacts on fisheries, eventually bringing benefits to regional economies and livelihoods.

EU policies

Climate change and sustainability are high on the agenda of the European Union. On 28 November 2019, the European Parliament adopted a resolution declaring a climate and environmental emergency in Europe and across the globe. On 11 December 2019, the Commission published a communication on the European Green Deal, a strategic priority first outlined in July 2019 in the political guidelines of Commission President, Ursula von der Leyen. The **Green Deal** includes the goal of making the European Union climate neutral by 2050, a target supported by all EU institutions, and aims to safeguard ecosystems and biodiversity.[10]

The 'farm to fork' strategy, announced in the Green Deal and published in May 2020, addresses the challenges of sustainability in the food supply chain and aims to bring environmental, health and socio-economic benefits. While its primary focus is on agriculture, it notes that **seafood and farmed fish** generate a lower carbon footprint than land-based animal production and announces the ongoing process to update the strategic guidelines on aquaculture. The strategy also aims to support the algae industry, as 'an important source of alternative protein for a sustainable food system and global food security'.[11] With regard to the common fisheries policy (CFP), the strategy mentions the forthcoming assessment of the CFP in 2022, but puts it in the context of 'how the CFP addresses the risks posed by climate change'. In an opinion on the 'farm to fork' strategy, adopted in the European Parliament PECH Committee in April 2021, the rapporteur, Izaskun Bilbao Barandica (Renew Europe, Spain), welcomes the announced new strategic guidelines on aquaculture and the Commission's focus on climate change in its upcoming assessment of the CFP, but expresses disappointment at the lack of prominence of the fisheries and aquaculture sector in the strategy.

In May 2020, the Commission published its communication on a new EU biodiversity strategy, another important element of the Green Deal. The proposed strategy includes the objective of designating at least **30 %** of both the EU land and seas as **protected areas**, of which at least a third under stricter protection. This represents an ambitious target for EU waters as compared to the current situation. Today, about 11 % of EU seas are MPAs (8 % designated as Natura 2000 sites and 3 % designated under additional national legislation) and only 1 % of marine waters are under strict protection. Although the EU has exceeded the aforementioned Aichi target of establishing MPAs in 10 % of its marine waters by 2020, there are nevertheless important shortcomings in the current MPA network. The EEA's Marine Messages II report, for instance, highlights the need to close the remaining gaps within the existing MPA networks (especially offshore and deep-sea habitats), to ensure that all MPAs have effective management plans in place and to designate a significant part of the MPA network as marine reserves or 'no-take' zones where **extractive activities** are severely restricted or prohibited. The European Parliament, prior to the publication of the biodiversity strategy, supported the binding 30 % MPA target through its January 2020 resolution on the Green Deal. More recently, through its January 2021 resolution on measures to promote the recovery of fish stocks, it welcomed the new 30 % target and specified that this could include 'fish stock recovery areas, as provided for under the CFP' and 'areas where the most destructive fishing techniques and economic activities are restricted'. Furthermore, in a March 2021 opinion on the biodiversity strategy, the PECH committee welcomes the high level of ambition, but strongly recommends that such targets should be implemented on a case-by-case basis, tailored to local specificities. According to the rapporteur, Gabriel Mato (EPP, Spain), the most important thing is to ensure that the established protection zones actually cover areas with ecological value that needs to be protected. The opinion points out that protection zones are not necessarily incompatible with fishery and aquaculture activities, as long as they do not compromise the values of those protected areas and provided that they are established under scientific advice and that there is adequate management and control. The opinion also stresses the importance of spatial planning, which should take into account the sustainable development of fisheries and aquaculture.

In terms of well-established EU policies, the **integrated maritime policy** (IMP) established in 2007 is the framework that covers the entire maritime economy and aims to develop coordinated, coherent and transparent decision-making on all policies affecting the oceans, seas, islands, coastal and outermost regions and maritime sectors. The **Marine Strategy Framework Directive** (MSFD), adopted in 2008, constitutes its environmental pillar and sets out a legal framework in the field of marine environmental policy. Its holistic approach towards human-induced environmental pressures affecting marine ecosystems (such as eutrophication, damage to the sea-bed, marine litter, introduction of non-indigenous species and underwater noise) aims to enhance and preserve the resilience of marine ecosystems. While assessing the impacts of climate change is not a specific objective, the directive helps to distinguish broader impacts of climate change, such as hydrological changes (e.g. changes in salinity, water temperature, sea level), changes in water chemistry (in particular increased acidification), and biological changes (e.g. in species distribution). It also helps explore solutions to mitigate climate change and apply an ecosystem-based approach to climate change adaptation. The 2020 Commission implementation report stated that considerable efforts had been made to integrate and develop completely new measures, but that not all the pressures on the marine environment were properly covered. The target of achieving good environmental status by 2020, as required by the directive, has therefore not been reached and more action is needed post-2020. The MSFD will be reviewed by mid-2023 and, if necessary, amended. The implementation report was published on the same day as the above-mentioned Marine Messages II report. The EEA points to the poor condition of Europe's seas due to overexploitation of marine resources, pollution and climate change, but also draws lessons from observed successes in marine recovery and proposes further solutions based on an ecosystem-based management. In November 2020, the European Court of Auditors (ECA) published a report on the protection of the marine environment through the EU's environmental and fisheries policies. Overall, the audit concludes that while a broad EU regulatory framework exists and some measurable progress has been made, there is insufficient restoration of important ecosystems and habitats. The Court recommends strengthening the links between environmental and fisheries policies, improving conservation measures in the Mediterranean (including possible new fishing restricted areas) and increasing funding for marine conservation objectives.

The **conservation of marine biological resources**, an exclusive EU competence, is at the heart of the CFP.[12] This implies that legislation on matters referring to **marine fisheries resources** is implemented through EU regulations directly applicable in Member States. The latest 2013 reform of the CFP represented a major milestone, requiring exploitation of all stocks at sustainable levels by 2020, namely restoring and maintaining them above levels capable of producing MSY. In its communication on the state of play ahead of proposing the fishing opportunities for 2021, the Commission highlighted the important progress made in the north-east Atlantic and adjacent seas, where biomass was 48 % higher in 2018 than in 2003 for fully assessed stocks. For 2020, it is estimated that more than 99 % of the landings in the Baltic, North Sea and the Atlantic managed exclusively by the EU came from sustainably managed fisheries.[13] Some stocks however continue to be overfished and/or fall outside safe biological limits, and more effort is needed to bring these stocks to sustainable levels. In the Mediterranean and Black Seas, the fishing mortality level is still very high, indicating overexploitation of the stocks well above the sustainability objective of the CFP. In some cases, the poor status of certain stocks is the result of other human-induced pressures (such as climate change and pollution). While these factors have to be addressed, pressure on fishing of those stocks must be eased to allow recovery. This is for example currently the case for eastern Baltic cod, which is suffering from various environmental pressures, including low oxygen and high water temperatures and for which the fishery has been closed since mid-2019.

When it comes to measuring the impact of climate change, free and open marine data, provided through EU's Copernicus Marine Service or the European Marine Observation and Data Network (EMODnet), is of valuable support for the marine food sectors.[14] A draft own-initiative report for the PECH committee looks specifically into **the consequences for fish stocks and fisheries related to rising seawater temperatures**. In her draft report, discussed in the PECH committee on 3 December 2020, rapporteur Rosanna Conte (ID, Italy) highlights the Mediterranean as one of the most prominent and vulnerable climate change hotspots, where climate change contributes to a decline in native pelagic species (such as anchovy and sardine), the arrival of non-indigenous species and a higher risk of disease outbreaks in aquaculture. In addition to the need for increased climate action and reinforced scientific programmes, Conte calls for an institutional response (including impact assessments, regionalisation, cross-border cooperation and adaptation measures).

Not only do fisheries and aquaculture suffer the impacts of climate change, they also contribute to it through their **GHG emissions**. According to the above-mentioned 2018 FAO report, fishing vessels accounted for 0.5 % of total global CO_2 emissions in 2012, while it was estimated that emissions from aquaculture represented around 7 % of those from agriculture in 2010. The Commission's 2020 blue economy report noted that between 2009 and 2017, gross value added in EU fisheries and aquaculture increased by 41.5 % while the sector's GHG emissions increased by 0.5 %, representing a decrease in emission intensity of 29 %. While there is still ample room for improved energy efficiency in fishing vessels, any subsidies in this area are controversial as they include the risk of enhancing fishing capacity, sustaining otherwise unprofitable fisheries and possibly contributing to overfishing. The global objective of prohibiting certain forms of fisheries subsidies that contribute to overcapacity is the subject of long-standing negotiations at WTO level. Regarding EU subsidies for the fishing fleet, the co-legislators reached a provisional agreement in December 2020 on the fund dedicated to the common fisheries policy and the integrated maritime policy for the 2021-2027 programming period, called the **European Maritime and Fisheries and Aquaculture Fund** (EMFAF). The compromise allows for fleet investments under strict conditions. It allows, for example, financial support for engine replacement or modernisation for vessels up to 24 metres, provided the new engine has not more power than the current one and, in addition, for vessels between 12 and 24 metres, the new engine should emit at least 20 % less CO_2. Along with investments in the fleet, good fisheries management results in an increase in biomass by reducing fishing pressure, ultimately leading to higher profits, greater fishing efficiency and lower emissions.

In addition, as indicated above as a solution, oceans can make a huge contribution in closing the emissions gap by unlocking their potential for **offshore renewable energy**, an area in which Europe is a world leader. According to a report from the wind industry association WindEurope, offshore wind installations in the EU represented a capacity of 14.6 GW by the end of 2020, covering 2 % of total EU electricity demand. The bulk of the installations (97.8 %) are located in just four countries: Germany, the Netherlands, Belgium, and Denmark.[15] An additional 26 GW is to be installed over a period of five years (2021-2025), with the North Sea, and to a lesser extent the Baltic Sea, remaining the centre for development. In the long term, the EU outlook for offshore wind is very ambitious. In the context of the Green Deal, in November 2020 the Commission published its communication on an offshore renewable energy strategy, in which it aims for 60 GW offshore wind capacity by 2030, with a view to reaching 300 GW by 2050, a 20-fold increase compared with the current situation. According to Commission estimates, this would cover 30 % of EU electricity demand in 2050. To expand into the deeper seas in the Atlantic, the Mediterranean and the Black Sea, the strategy aims to apply the emerging technology of floating offshore wind solutions. Other offshore renewable energy solutions envisaged in the strategy are at a much earlier stage of development and include ocean energy (mainly tidal and wave), floating solar panels and algae biofuel. In particular for tidal and wave energy, all projects worldwide currently use EU technology and about 39 % of global capacity is installed in EU waters, which still represents a modest capacity of only 34 MW. The strategy recognises the promising potential of ocean energy and aims to increase it to 1 GW by 2030 and to 40 GW by 2050. The EU is also investing heavily in research and innovation in these emerging technologies. The enormous expansion of offshore renewable energy will have to be in line with existing environmental and maritime EU policies, such as the Nature Directives, the biodiversity strategy, the MSFD and the CFP. Along with publication of the offshore renewable strategy, the Commission has published updated guidance on how to reconcile the development of offshore renewable energy with marine protection.

Maritime spatial planning (MSP) is seen as an essential and proven tool for managing marine waters more coherently, avoiding conflict and creating synergies between sectors of the blue economy. The 2014 MSP Directive can be considered the economic pillar of the EU's IMP. The directive required the 22 coastal Member States to establish plans for their waters by the end of March 2021 and the Commission is now expected to publish an implementation report within a year of this deadline. Not only should the plans cover the spatial and temporal distribution of existing and future activities in marine waters, they should also take into account land-sea interactions and be based on an ecosystem-based approach. Cross-border cooperation is key here and several projects covering this aspect have received EU support. As part of EU assistance to Member States, a dedicated website and exchange platform offers a wealth of resources on MSP implementation, for example on how to manage conflicts between sectors. A challenge will be to reconcile the designation of new marine protection and offshore renewable energy sites with the activities of established sectors such as fisheries and marine aquaculture. Fishing activities are typically not permitted in offshore wind farms and where they are permitted fishermen tend to avoid them because of the risk of accidental damage, snagging of fishing gear and high insurance fees. A PECH committee draft own-initiative report looks into **the impact on the fishing sector of offshore windfarms and other renewable energy systems**. In the context of this report, a research study commissioned by the PECH committee examined the impacts and possible pathways for co-existence. In a spatio-temporal overlap analysis of offshore wind development and the fishing activities of European fleets, the study finds a strong increase in potential for spatial conflicts in the North Sea, the Baltic Sea, and the Mediterranean Sea in the medium term (until 2025) and in the Atlantic and Celtic Sea regions in the long term. In the Baltic, Celtic, and North Seas, offshore wind expansion would affect mostly fishing fleets that deploy trawl gears targeting demersal fish and crustaceans. Overall, restricting fishing activities in a larger area would likely lead to the relocation of those activities (including the associated industries and logistics). In addition, the study notes that an analysis of the impacts on local fishing communities and onshore economic activities is hampered by the lack of socio-economic data. Despite a strong emphasis on the co-location of activities, real world examples are still scarce.[16] In the draft report, the rapporteur, Peter van Dalen (EPP, the Netherlands) is of the opinion that the combination of offshore wind farms and marine protected areas should be further investigated and believes that the fishing industry should be properly involved in the planning and design of offshore wind farms.

As part of the IMP, the EU also adopts sea-basin-specific maritime strategies. In July 2020, the Commission published its Atlantic maritime strategy, i.e. an updated action plan to unlock the potential of blue economy in the Atlantic area while preserving marine ecosystems and contributing to climate change adaptation and mitigation. One of the four pillars of the strategy is to ensure that the Atlantic area is healthy and that the coasts are resilient. In particular, attention is drawn to the increased risks of major storms, floods and erosion, adversely affecting large parts of the coasts. Among the actions it proposes to address these problems are a comprehensive monitoring and alert system for increased storms and floods, development of coastal protection pilots and promotion of nature-based solutions, and the mapping and monitoring of coastal wetlands for preservation and their role as carbon sinks. In a draft opinion on the strategy, voted in the European Parliament PECH committee in April 2021, rapporteur Pierre Karleskind (Renew, France) deplores the fact that the strategy makes virtually no mention of fisheries and aquaculture and believes that it should incorporate links with the 'farm to fork' and biodiversity strategies, in order to generate synergies between these initiatives.

Through international cooperation and commitments, the EU is an active player in shaping global **ocean governance**. At the latest global 2019 'Our Ocean' conference in Oslo, the EU made 22 new commitments, worth nearly €540 million, covering areas such as pollution, marine protection, sustainable fisheries and climate action. The EU is also one of 10 signatories (along with Canada, China, Denmark – in respect of the Faroe Islands and Greenland, Iceland, Japan, Norway, the Russian Federation, South Korea and the United States) to a recently negotiated agreement to prevent unregulated commercial fishing in the high seas of the central **Arctic Ocean**, which is likely to become more attractive to commercial fisheries in the medium and long term. In addition, the EU is playing an active role in the negotiation of a new international legally binding instrument under the United Nations Convention on the Law of the Sea (UNCLOS) on the conservation and sustainable use of **marine biological diversity of areas beyond national jurisdiction** (BBNJ). Formal negotiations have been ongoing at the United Nations since 2018. Ahead of the fourth round of negotiations, the Commission organised an international workshop in January 2020 on issues relating to environmental assessments.

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ENDNOTES

[1] The 'marine living resources' sector refers to fisheries and aquaculture, including processing and distribution.

[2] The IPCC is a UN body established in 1988 and responsible for assessing science related to climate change.

[3] The fifth assessment report (AR5) was completed in 2014 and the sixth (AR6) is expected to be completed in 2022.

[4] In the Baltic Sea, the 20th century saw a 10-fold increase in hypoxia. Significant reductions in nutrient loads into the Baltic Sea in the last couple of decades have however slowed the expansion of hypoxia.

[5] For example, the absolute upper temperature limit for Atlantic cod to spawn in the Celtic and North Sea is 9.6 °C and recent evidence shows that spawning sites of Atlantic cod are heading towards the Arctic Sea.

[6] Chapters 5 and 7 cover the impacts on the North-East Atlantic and Mediterranean (and their adjacent seas) respectively.

[7] MSY refers to the highest amount of fish that can be taken from a stock without affecting its reproduction.

[8] The climate-related hazards for 140 marine fish and shellfish species (523 stocks) were estimated, covering more than 90 % of the total commercial value of European fisheries (see also Figure 4.4 of the CERES report).

[9] Following the adoption of the UN Framework Convention on Climate Change (UNFCCC) at the 1992 Earth Summit.

[10] On 4 March 2020, the European Commission adopted a proposal for a European climate law that establishes the framework for achieving the climate neutrality objective.

[11] The Commission's Joint Research Centre has published a new algae section on its knowledge for policy pages and an upcoming public consultation launched by the Commission would lead to the adoption of an algae strategy.

[12] The other four are the customs union, competition policy, the monetary policy of the euro area and trade policy.

[13] As they are taken from the commercial fish stocks for which the total allowable catches set by the Council are in line with the maximum sustainable yield.

[14] For example, as in this recent event for the aquaculture sector in the Mediterranean and Black Sea regions.

[15] The other EU countries with offshore wind installations are Finland, France, Ireland, Portugal, Spain and Sweden.

[16] Recent examples are the pilot projects as part of the EU-funded research project United.

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