Turning the Tide on EU Seas with a Green Recovery

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SUMMARY

Oceans cover almost three-quarters of the planet, yet we are only just beginning to discover the true extent of these ecosystems and their impacts on our lives. The marine environment provides up to two-thirds of the ecosystem services supplied by the planet's natural capital. We know that the marine environment, and therefore the blue economy that depends on it, is particularly vulnerable. The climate and biodiversity crises have not been put on hold because of the pandemic and continue to need urgent attention and action.

There is great potential in green recovery where investments deliver a healthier environment and a healthier economy. Investments in the marine environment can yield particularly large returns. Yet, it is estimated that governments around the world spend over 22 billion dollars annually on capacity-enhancing, harmful financial incentives and subsidies in the fisheries sector alone. The marine ecosystem is already on the brink, yet the EU continues to invest in these harmful incentives. The EU's Green Recovery plan is a golden opportunity to ensure that these resources are redirected and contribute to a sustainable recovery also at sea.

Long-term policies will need to enable a true Green Recovery. Financial investments will be mobilised to mitigate the economic fall-out of the COVID-19 crisis and to align the EU with its Green Deal ambitions. Therefore, it is crucial that the new recovery instrument, Next Generation EU and funding programmes such as the EMFF enable the EU to tackle our long-term environmental crisis and avoid undesirable trade-offs, while simultaneously improving the Union's current economic prospects.

The paper dives into examples of investment opportunities in an effort to illustrate how a green recovery for the oceans is possible, for instance by:

- Actively restoring marine ecosystems, such as rebuilding oyster reefs and fish passages in coastal dams
    - This can stimulate economic activities in sectors such as marine construction while increasing fish production, improving water quality and recovering threatened ecosystems.
- Enabling transparent, accountable and more selective fishing activities by scaling up remote electronic monitoring (REM)
    - This type of technology further increases the transparency of catch data and improves confidence in scientific assessments.
- Stopping plastic pollution at its source through investing in the re-use/rental/re-fill sectors
    - This win-win investment creates employment opportunities while stopping harmful pollution streams that are expensive or impossible to clean up.

The biodiversity and climate crises and the need to rebuild the EU's economy go hand in hand. There is no reason not to invest in a green future for the ocean. Following the EU Green Deal, the Biodiversity Strategy and the Farm to Fork Strategy, future financial commitments that impacts seas and oceans must continue to build on this momentum and walk the walk of this political agenda.

Introduction

With the publication of the EU Green Deal in 2019, followed by the Biodiversity and Farm to Fork Strategies in 2020, the EU must now change how it invests in order to align with these overarching policies.

Financial investments will be mobilised to mitigate the economic fall-out of the COVID-19 crisis in the EU. Increased efforts are expected through the recovery instrument, Next Generation EU, which intends to mobilise significant resources from the financial markets and relay those to the Member States through both existing and new programmes, in order to support their economic recovery.

Long-term policies will need to confront the current reality, including the funds under the 2021-2027 Multiannual Financial Framework (MFF) such as the European Maritime Fisheries Fund (EMFF). Many of the investments will be linked to regulatory changes such as effectively protecting 30% of the EU's seas, with the strictest protection applying to one third of those areas.

The climate and biodiversity crises have not been put on hold because of the pandemic and continue to need urgent attention and action. Therefore, it is crucial that the new recovery instrument and funding programmes such as the EMFF enable the EU to tackle our long-term environmental crisis and avoid undesirable trade-offs, while simultaneously improving the Union's current economic prospects.

Whether the post COVID-19 recovery efforts will result in a truly sustainable future for the EU depends on the orientation of the recovery response and future investment. Given the sheer volume of potential support, individual response investment options should be appraised using a framework[1] of ten principles (e.g. efficiency, rationality, and anti-abuse), in order to balance the needs of a healthy marine environment. Utilising these same principles, this paper looks at the investment opportunities that can stimulate the economy.

Fortunately, an investment plan already exists for this moment. The Blue Manifesto[2], supported by over 100 environmental NGOs, offers a plan to achieve healthy oceans by 2030. This plan is even more relevant in the context of tackling the climate and biodiversity crises while having a successful economic recovery post COVID-19. This paper focuses on the opportunities that can be made available by investing in the three main areas set out in the Blue Manifesto:

[1] Carpenter, G., 2020. Setting the Right Safety Net: A Framework for Fisheries Support Policies in Response to Covid-19. New Economics Foundation.

[2] https://www.birdlife.org/europe-and-central-asia/news/blue-manifesto-roadmap-healthy-ocean-2030

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Achieving the Blue Manifesto: Investment opportunities

The Blue Manifesto has identified three main paths that the EU needs to tackle in order to achieve healthy oceans by 2030: restore natural areas, transition to sustainable and low impact seafood systems, and halt pollution. To this end, investments that are made to achieve these goals while ensuring they do not expand the overcapacity of sectors are positive investment opportunities. These will not only support coastal areas in recovering from COVID-19, but also support tackling the biodiversity and climate crises - enabling a green recovery for the oceans.

Nature restoration & conservation

Oceans degrade because of various human activities and there is a pressing need to halt the decline in biodiversity and restore lost ecosystem functioning and services at sea. The EU has established key legislation to ensure this happens, including the Birds Directive, the Habitats Directive and the Marine Strategy Framework Directive. The new EU Biodiversity Strategy further includes legislation to set restoration targets.

Restoration is the attempt to recover the original state of the ecosystem through active manipulation or passive natural recovery. Conservation is the act of preserving the current system by mitigating human activities. Restoring and conserving nature at sea can create long-lasting ecosystem services and research has shown that restoration and conservation efforts can lead to significant employment generation in various sectors[3]. Employment impacts can be immediate, for example, through construction work, but further long-term opportunities can also be created for tourism, which is among the sectors hit the hardest by the COVID-19 crisis. Restoration and conservation efforts also

[3] BenDor T. et al. (2015): Estimating the Size and Impact of the Ecological Restoration Economy, PLosOnE 10(6)

help rebalance the interests of coastal areas, creating employment and lasting assets while increasing the resilience of coastal areas against future challenges such as climate change.

Effective nature restoration and conservation at sea require adequate and efficient monitoring programmes. These programmes ensure that the availability of systematic information of marine ecosystems help determine their health and resilience. In Finland, the yearly cost for its national marine biodiversity monitoring programme, which includes monitoring mammals, birds, fish, and benthic and pelagic habitats (coastal and offshore) totals €5.91 million. The expected net benefits from management options taken, based on the information collected through the Finnish monitoring programme, have been estimated at up to €1.848 billion.[4]

1. Active restoration

There is a wealth of research[5] showing that many degraded marine ecosystems will not recover from the stress of human activities unless there is some form of artificial manipulation. These manipulations include actively restoring seabed habitats such as transplanting plants or corals to the degraded areas, or creating artificial nests to increase the use of certain coastal areas by seabirds. Investments in research and development on marine ecosystem restoration need to be scaled up.

Oyster reefs, for example, are crucial biodiversity hotspots in European waters as they engineer ecosystems. Oysters build reef habitats that provide better water quality, decrease local toxic algal blooms, increase nutrient uptake, increase bentho-pelagic coupling, and increase species richness and multidimensional biogenic structures, which provide habitat, food, and protection for numerous invertebrate and fish species. They also play a role in disaster risk reduction, by buffering coastlines from the impacts of storms and other climate-induced meteorological events.

Europe used to have vast oyster reefs that provided food and clean water for centuries. Considering the high value of oyster reefs in maintaining the resilience of our ecosystems and fighting the climate and biodiversity crises, a large-scale and long-term native oyster active restoration programme would be beneficial in European waters.

Estimates in the USA show that for $1 million invested in oyster reef restoration, 16.6 jobs were created.[6] Oyster reef restoration projects can, on average, cost $135.63 per m^2.[7] With such an investment, the EU would create direct jobs on the ground such as loading crews, fishers, scientists, technicians, biologists, divers, mining and quarry workers, and truck drivers. It would also support indirect jobs in industries that supply materials (e.g. nurseries, lumber, steel, concrete and cement products). It would further induce jobs by boosting employment benefiting from the restoration of the oyster reef such as tourism and recreational activities.

Another example is the restoration of fish migration paths. Around the world, fish have been restricted in their ability to swim from seawater to fresh water or vice versa. The reason for this is the global construction of dams, dykes and other obstacles in rivers and delta areas. In the

[4] Nygård, H., Oinonen, S., Hällfors, H.A., Lehtiniemi, M., Rantajärvi, E. & Uusitalo, L. (2016). Price vs. value of marine monitoring. *Frontiers in Marine Science*, 3: 205.

[5] Rinkevich, Baruch. "Conservation of coral reefs through active restoration measures: recent approaches and last decade progress." *Environmental Science & Technology* 39.12 (2005): 4333-4342.

[6] Edwards, P.E.T., Sutton-Grier, A.E. and Coyle, G.E., 2013. Investing in nature: restoring coastal habitat blue infrastructure and green job creation. *Marine Policy*, *38*, pp.65-71.

[7] Narayan, S., et al., 2016. The effectiveness, costs and coastal protection benefits of natural and nature-based defences. PloS one, 11(5).

Waddenzee, Netherlands, it cost approximately €60 million[8] to improve the connectivity of rivers and oceans by building a permanent entrance in the Afsluitdijk - a dam that prevents fish from migrating up the river. This is an active method of restoring fish accessibility to their spawning grounds and helps restore wild fish populations, including the critically endangered Atlantic salmon.

Although some types of active restoration can have relatively high costs, certain species and habitats cannot recover without active manipulation. Therefore, active restoration is crucial to restore certain types of habitats and species.

2. Passive restoration

Passive restoration is the concept of allowing the ecosystem to naturally recover by limiting human pressure. The use of passive restoration methods is more widespread because it is linked to enforcing environmental rules and therefore has less risk and fewer logistical problems than active restoration. The success of passive restoration depends on the arrival of wildlife to colonise the degraded area. Since the response of wildlife can be uncertain, passive restoration can sometimes not be sufficient for recovering wildlife flora and fauna.

Nevertheless, in the marine environment, the concept of "no-take zones" as a form of passive restoration has been widely effective in marine protected areas. For example, the biomass of whole fish assemblages in a no-take zone is, on average, 670% greater than in adjacent unprotected areas, and 343% greater than in partially protected areas.[9] Foregone economic opportunities are replaced by green investment opportunities. No-take zones create jobs such as scientific researchers, field surveyors and monitors as well as enforcement officers. Furthermore, because of the restoration effects of no-take zones, it often improves surrounding tourism. In six no-take zones in parts of Gökova Bay, Turkey, trawling and purse seine activity was restricted, leading to a 400% increase in the income of fishers.[10]

The costs related to enforcing access in no-take zones depend on factors such as size, location, regulations, local practices and customs, and the available technology. For example, a global positioning satellite network that automatically monitors the location of fishing vessels, or alerts authorities if a fishing vessel enters a closed area will greatly reduce the costs of enforcement. Around the Great Barrier Reef in Australia, satellite tracking of fishing vessels has reduced the need for fishery patrol vessels.[11]

In a Marine Protected Area (MPA) of 21km^2 in Lira, Spain ("Os Miñarzos") where 6.75% are no-take zones, surveillance costs were up to €180,000 per year, including the costs of coordination and human resources (eight people), as well as the maintenance of equipment (one speedboat and one patrol car). Monitoring costs were approximately €129,000 per year. This covered salary costs for one staff member to perform biological monitoring tasks for almost four years, for one staff member for the Fishermen's Guild of Lira and for the development of an inventory of the biodiversity of the MPA by a university, among other tasks.[12]

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[8] Based on correspondence with Wouter van der Heij, Fish Migration River Project leader, Waddenvereniging

[9] Enric Sala, Sylvaine Giakoumi, No-take marine reserves are the most effective protected areas in the ocean, *ICES Journal of Marine Science*, Volume 75, Issue 3, May-June 2018, Pages 1166–1168.

[10] Rupert Haines, Caroline Hattam, Mia Pantzar, Daniela Russi.(2018). Study on the Economic Benefits of MPAs.

[11] The Economist. 2001. The benefits of marine reserves. February 24th. p.83.

[12] Stefanie Broszeit, Rupert Haines, Matt Rayment, Caroline Hattam, Mia Pantzar, Daniella Russi. (2018). Study on the economic benefits of MPAs and SPMs. 10.2826/028742.

3. Managing Marine Protected Areas

Marine Protected Areas (MPAs) is a term applied to many different concepts that protect estuarine, coastal and offshore systems, fisheries resources, habitats of particular importance, critical habitats of endangered species and parks for public enjoyment.[13] They are often referred to as sanctuaries, ecological reserves, refuges, national marine sanctuaries and marine parks and are designed to meet different objectives. In the EU, most MPAs are designated as Marine Natura 2000 sites, which are regulated by the Birds Directive and the Habitats Directive. In reality, however, the vast majority of European MPAs remain largely unprotected: 85% of MPAs lack management plans and measures, generating little to no benefits to the marine life they intend to protect[14]. Worse, some of the most destructive human activities at sea currently take place freely inside MPAs: a 2018 study found that 59% of European MPAs are commercially trawled and with higher intensity than in non-protected areas.[15]

Managing marine protected areas can range from actions that completely remove all human activities (i.e. no-take zones) to areas that are open to human activities depending on how these impact the conservation objectives of the area. Therefore, MPAs can serve the purpose of restoring ecosystems, as well as maintaining a healthy system of human activities. An effective way to manage activities in marine protected areas is a management consortium approach (e.g. co-management) where local authorities work together with stakeholders and take joint decisions. It requires the proper financing of effective enforcement/surveillance activities, as well as empowering communities to care for the protection of the area.

By working with coastal communities to support the enforcement of protected areas, individuals in these communities are less likely to engage in illegal activities within the protected area. Locals may also contribute to enforcement through surveillance and deterrence of illegal activity conducted by non-locals.[16] A co-management approach is therefore an effective way to not only create coastal jobs, but to also deter illegal activities.

The costs related to setting up community-based management requires both supporting a functioning surveillance and enforcement system, and also covering the costs of representatives of different stakeholders, together with scientists, to meet as equals and take joint decisions. In the Italian Adriatic coast, the costs of managing the Torre Guaceto MPA was around 1.2 million Euros in 2017, of which approximately 600,000 Euros covered salaries for the consortium. The MPA was able to generate 29% of its own income from tourism.[17]

Transition to sustainable and low impact seafood production

Seafood production, if done sustainably i.e. with a sustainable and low impact on the marine environment, can help safeguard the health of our marine ecosystems, while supplying food and supporting economic livelihoods. The EU's Common Fisheries Policy (CFP) sets the scene for providing transitioning to sustainable seafood production, together with several other fisheries regulations. The new Biodiversity strategy and Farm to Fork strategy further pursue this transition.

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[13] Hyrenbach, K. David, Karin A. Forney, and Paul K. Dayton. "Marine protected areas and ocean basin management." *Aquatic conservation: marine and freshwater ecosystems* 10.6 (2000): 437-458.

[14] WWF, Protecting Our Ocean: Europe's challenges to meet the 2020 deadlines (September 2019)

[15] Dureuil, M. et al. (2018). Elevated trawling inside protected areas undermines conservation outcomes in a global fishing hot spot. Science, 362(6421), 1403-1407.

[16] Brown, Christopher J., et al. "The cost of enforcing a marine protected area to achieve ecological targets for the recovery of fish biomass." *Biological conservation* 227 (2018): 259-265.

[17] Stefanie Broszeit, Rupert Haines, Matt Rayment, Caroline Hattam, Mia Pantzar, Daniella Russi. (2018). Study on the economic benefits of MPAs and SPMs. 10.2826/028742.

Recovery funds should invest in technologies that can help us monitor oceans more efficiently and effectively, such as systems that can help us analyse and interpret remote monitoring. We should also be resorting to fisheries science to design intelligent harvest-yield protocols (also known as harvest strategies) that can maximize the long-term benefits of sustainable management practices.

1. Transition to sustainable and low-impact fisheries

Ending overfishing is an essential step to lower the impact of fishing on the marine environment. Overfishing takes away the possibility of fish populations to replenish. Furthermore, a reduced number of fish will require increased fishing effort to achieve the same volume of catch, therefore resulting in more incidental bycatch, more habitat degradation and more fuel consumption. According to the Food and Agriculture Organisation of the United Nations (FAO) and World Bank estimates, the global economy could profit up to $50 billion annually by restoring fish stocks and reducing fishing capacity to an optimal level.[18] By rebuilding fish populations, the EU could feed an extra 89 million citizens, gain an extra €1.6 billion in annual revenue and create over 20,000 new jobs.[19] Overfishing is still a widespread problem across the EU, affecting 69% of its fish stocks.[20]

Sustainable and low impact fishing also means using fishing gears and techniques that have the lowest possible impact on the marine ecosystem. These changes would include, for example, shifting from active mobile gear such as heavy trawls and dredges to passive gear such as fish traps. Techniques can also include, for example, limiting specific types of fishing in areas where certain animals aggregate and are more vulnerable to fishing.[21] Marine ecosystems are highly impacted by destructive and non-selective fishing practices. This includes species of marine mammals, seabirds, sea turtles, sharks and rays incidentally caught by fishing gear as well as sensitive habitats like coral reefs destroyed by trawling.

Not all fisheries affect the environment to the same extent. They vary greatly depending on gear and operating environment and time. Heavy trawls and dredges that scrape over or dig into the bottom have the most impact on the environment, both in terms of habitat destruction and selectivity, as well as in terms of carbon emissions. To date, there are too few incentives for a transition to sustainable and low impact fishing. Small-scale artisanal fisheries can often, but not always, have less impact on the environment and provide more jobs. Those sections of the small-scale fleets that have a high possibility to transition to sustainable and low impact fishing should therefore get special attention in the green recovery.

A shift to sustainable and low-impact fishing is an investment to help fishers find and roll out solutions to destructive fishing activities. For example, by changing gear type such as from conventional trawl fisheries to more passive creel (basket) fisheries to catch Norway lobster would reduce the impact on the seafloor area from 33,000 m^2 to 1.8 m^2 per kilo of lobster. It would also reduce the amount of unwanted catches from 4.5 to 0.36 kilos and reduce the need for fuel from nine to 2.2 litres. Moreover, the lobster caught by a creel is of better quality and will fetch a better price[22]. In the American oyster fishery, switching from dredging and tonging to diver harvesting (a more sustainable and low impact form of fishing) produced 25-32% more oysters for the same

[18] http://www.fao.org/news/story/en/item/120936/icode/
[19] Carpenter, G., 2020. Landing the blame: overfishing in the Northeast Atlantic 2020
[20] Froese, Rainer, et al. "Status and rebuilding of European fisheries." Marine Policy 93 (2018): 159-170.
[21] Gascoigne, Jo & Willsteed, Edward. (2009). Moving Towards Low Impact Fisheries in Europe - Policy Hurdles and Actions. 10.13140/RG.2.2.26042.90562.
[22] Ziegler, F. and Valentinsson, D., 2008. Environmental life cycle assessment of Norway lobster (Nephrops norvegicus) caught along the Swedish west coast by creels and conventional trawls—LCA methodology with case study. The International Journal of Life Cycle Assessment, 13(6), p.487.

amount of time-spent fishing. Acceptance of diver harvesting by the industry would require training in diving skills and safety, education and demonstration of the advantages of this method.[23]

Other types of solutions can also include relatively simple technical changes, for example, rolling out hookpods to longline fishing vessels to minimise bycatch of seabirds or the use of coloured LED lights to stimulate an escape response of certain unwanted fish species. Hookpods are a technical innovation that keeps the longline hooks enclosed until they reach a certain depth, drastically reducing the levels of seabird bycatch, in some cases by almost 95%.[24] The costs can range depending on the innovation of the technology. Hookpods can cost around $8.50 per unit, which based on an average 1000 branchlines used in a pelagic longline vessel represents an initial capital cost of $8500 per vessel. A much cheaper innovation are bird scaring devices, costing around $200, which with enough wind, can reduce bycatch by 70 - 90%.[25]

Investment opportunities can also include support to research initiatives as well as providing fishers with low-interest loans to support uptake of new low impact technology. Both fishers and the environment will benefit from a shift to sustainable and low impact fisheries: it will decrease the damage to marine ecosystems, which could in turn produce higher fish yields and therefore improve economic benefits.

2. Diversification in the fisheries sector

The viability of the European fishing sector is dependent on ending overfishing and overcapacity, which means that, in some cases, fishers will need to diversify their economic activity, or even completely change jobs. If developed while respecting nature, eco-tourism can be an important economic sector for coastal areas and can be a desirable and profitable alternative regarding job opportunities.

Ocean tourism comprises a range of tourism, leisure and recreation-oriented activities that take place from coastal to open water areas. This tourism therefore involves activities around the sea, beaches, landscape, biodiversity, food, as well as cultural and built heritage associated with these waters. Investment opportunities can be used for upgrading tourism facilities that connect fishers to visitors. It can also support fishers through dedicated schemes to volunteer to re-adapt their fishing vessel for touristic business purposes with the condition that the fishing license is removed (i.e. not sold to another fisher). In the case of a fisher in Algarve, Portugal, the total cost to invest into using fishing vessels as dolphins and whale watching vessels was approximately €90,000, of which the fisher invested 38% from his own resources.[26] In the Azores, Portugal, the whaling fishing business was entirely replaced by whale watching tourism, which resulted in benefits for the local communities.[27] The shift from extractive to non-extractive use has the potential for promoting species conservation and supporting local economies. Nevertheless, adequate rules must be put in place to reduce the negative impacts on wildlife and the transition must support all stakeholders.[28]

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[23] Lenihan, H.S. and Peterson, C.H., 2004. Conserving oyster reef habitat by switching from dredging and tonging to diver-harvesting. *Fishery Bulletin*, *102*(2), pp.298-305.

[24] Sullivan, B. J., et al. "At-sea trialling of the Hookpod: a 'one-stop' mitigation solution for seabird bycatch in pelagic longline fisheries." *Animal Conservation* 21.2 (2018): 159-167.

[25] Maree, Bronwyn A., et al. "Significant reductions in mortality of threatened seabirds in a South African trawl fishery." *Animal Conservation* 17.6 (2014): 520-529.

[26] EcoExplorer FLAG project in 2011, Algarve Portugal: https://webgate.ec.europa.eu/fpfis/cms/farnet2/on-the-ground/good-practice/projects/ecoexplorer-marine-mammal-observation-algarve_en

[27] https://wwhandbook.iwc.int/en/case-studies/azores-portugal

[28] Mazzoldi C, Bearzi G, Brito C, Carvalho I, Desiderà E, Endrizzi L, et al. (2019) From sea monsters to charismatic megafauna: Changes in perception and use of large marine animals. (2019) PLoS ONE 14(12): e0226810. https://doi.org/10.1371/ journal.pone.0226810

Fishers can also join schemes that train and employ them as marine protected areas rangers. They can also be retrained to assist with the maintenance of offshore wind farms or with the collection of data for research programmes.

Diversification can support households in coastal communities to insulate themselves from environmental and economic shocks, trends and seasonality - for example from pandemics such as COVID-19. In effect, diversifying the fishing sector can make them less vulnerable.

3. Tools for more reliable and comprehensive data

Scientific research should form the basis of seafood production in the EU. For example, all fishing vessels should be monitored to ensure data from the fishing sector is systematic, reliable and that all fish can be traced throughout the supply chain. This ensures that policy decisions are based on informed scientific knowledge.

Verified and timely catch data are essential to securing the long-term sustainability of European fisheries. If used correctly, they can deliver stock assessments, inform catch quotas, and determine the conservation risk of protected species. However, most fisheries dependent data continues to be sub-optimal[29] and management decisions continue to fail at properly addressing declining fish stock and tackling sensitive species bycatch.

Investment opportunities should aim to improve catch data such as investing on the tracking of all vessels and changing all logbooks to be electronic. This is particularly important since 89% of the total EU fleet is small scale and currently is not required to have a vessel monitoring system on board, although they are estimated to be responsible for at least 23% of EU catches. This requirement of vessel position data and electronic logbooks should therefore be extended to cover the small-scale fleet. There are already flourishing projects such as the voluntary monitoring schemes of Andalusia[30] known as 'green boxes' that have already successfully rolled out tracking systems to the small-scale fleet. Tools like the BigEye Smart Fishing technology by the company Bitcliq[31], traceability tools provided by Trace Register[32] and Provenance pilot blockchain technology[33] can not only help in tracking vessels but can also follow the fish until it is sold to the consumer, therefore greatly improving traceability.

The introduction of remote electronic monitoring (including CCTV) provides a mechanism for verifying data from fishing logbooks, which ensures that the EU's management decisions reflect the best available scientific advice. A CCTV system can be installed on a vessel, maintained, and the footage monitored, for €6,600 per year over five years[34]. This includes the purchase of four cameras, installation, data storage, monitoring and review of footage. This type of technology further increases the transparency of catch data, which improves the quality and confidence in scientific assessments. Remote Electronic Monitoring (REM) and CCTV use on fishing vessels is a rapidly

[29] WWF, Electronic Monitoring in Fisheries Management, 2015, http://assets.wwf.org.uk/downloads/fisheriesmanagement_2_.pdf
[30] https://vimeo.com/306855062
[31] http://www.bitcliq.com/bigeye/
[32] https://globalfishingwatch.org/markets/partnering-to-improve-seafood-traceability/
[33] https://www.provenance.org/tracking-tuna-on-the-blockchain
[34] WWF, Remote Electronic Monitoring in UK Fisheries Management, 2017, https://www.wwf.org.uk/sites/default/files/2017-10/Remote%20Electronic%20Monitoring%20in%20UK%20Fisheries%20Management_WWF.pdf

expanding field of monitoring and control with some EU Member States already implementing it, and the cost of the technology is constantly decreasing, while the quality of the data is improving.

To make EU fisheries fully documented it is also key that more public information is available on EU control and enforcement efforts. Increasing public information and transparency is a cost-effective way to create a culture of trust, collaboration and compliance. Making information on EU fisheries control efforts publicly available on an annual basis is a low cost, high return policy action. EU Member States are already providing information on control efforts to the European Commission, thus requiring no additional investments in capacity. Like many forms of illegal unreported and unregulated (IUU) fishing, this activity harms both fish populations and the fishing activities of legal operators. Investing in policies to ensure safe and controlled fisheries therefore represents a good use of public funds that promotes concurrent crisis response.

4. Ensuring compliance with the rules

Increased spending to support the implementation of conservation measures can only be effective if compliance and effective implementation of those measures are also ensured. With regard to EU fisheries regulations, very few Member States have issued sanctions that are truly effective, proportionate and dissuasive. For example, in France, the number of sanctions imposed for serious infringements was low, and the level of these sanctions did not meet the criteria set in EU law.[35] In addition, IUU is extremely costly to governments and citizens. The global annual cost of IUU fishing has been estimated at 19bn EUR.[36]

To address this, in addition to increased transparency on control efforts, greater financial support for administrative capacity is necessary for the control and effective implementation of the CFP rules. Investment opportunities could therefore arise by increasing the number of inspectors as well as improving the tools, equipment and technology available to carry out inspections. Concretely, the EU should strengthen the budget of the European Fisheries Control Agency, to ensure that an EU level playing field is created and maintained on control and enforcement, and that the EU fisheries regulations are properly implemented in all Member States. This should include the option of a second EU inspection vessel for the use of joint inspections by EFCA.

Furthermore, any EU support should be conditional to the strict adherence to EU rules. For example, one condition to grant EMFF support should be that the beneficiary has not committed a serious infringement of EU fishing rules. The current lack of level playing field concerning the effective enforcement of sanctions for serious infringements might create a supplementary discrimination and unfair commitment of EU money. Therefore, supporting an environmental enforcement officer in every coastal NUTS 3 region to support, advice and review infringement cases of, for example, fishing vessels, would greatly improve the enforcement of the rules. If the average cost of an enforcement officer in the EU is €40,000 annually, the total investment needed to support one enforcement officer in each coastal NUTS 3 region (i.e. 446 enforcement officers) is €125 million.

[35] Druel, E., 2019. The control of the Landing Obligation in France. ClientEarth
[36] http://www.iuuwatch.eu/iuu-fishing-facts-and-figures/

5. Skills development

The main reason for accidents in the fishing industry is human error rather than the design and construction of unsafe boats. Due to the competitive environment in fishing, increased investment in speed and catching efficiency further aggravates the problems of safety and security on board because investment repayment drives the urgency to catch more fish.[37] Therefore, increasing training on safety for fishers and skippers is an important investment opportunity to greatly reduce accidents at sea.

In Ireland, for example, authorities developed a 'Seafood skills and training', which attracted several applications for aid in 2018 costing around €6,500 per individual.[38] Other public aid was granted for equipment to improve hygiene, health and working conditions on board, such as sanitary facilities and galley facilities for crew, equipment to reduce manual lifting, insulation and increase ventilation.[39] Finally, the Fishery Harbour Scheme also aimed at improving safety conditions and working conditions in Irish harbours.

6. Transition to environmentally-friendly, low-impact aquaculture

The EU aims to boost its aquaculture production in order to meet the growing demand for seafood as well as to generate wealth and create jobs. However, even though significant progress improved the sector's environmental performance, various environmental challenges remain, including heavy dependence on wild-caught fish and its conflicts with nature, including habitat degradation. This can lead to overfishing, genetic changes to wild fish populations, and decline of sensitive species such as seabirds and dolphins.

To transition towards an environmentally-friendly, sustainable and low impact industry, the aquaculture sector needs to take a number of steps to address these issues, all of which require investments, which might include switching feed types, technological innovations, as well as linking to nature conservation.

Several projects show that the costs for setting up installations of recirculating and nutrient capture systems and recycling of nutrients in aquaculture farms can vary between €270,000[40] and €800,000[41], depending on the state and condition of the existing aquaculture farm. This activity entails upgrading existing aquaculture farms by installing more modern equipment (pumps, filtration, etc.) or circulation systems allowing for the reuse of water and reduction in energy costs. The benefits are wide ranging, from environmental benefits such as decrease in water pollution to economic benefits such as reduced water costs and additional income generated by growing an additional crop (e.g. fruits and vegetables farmed in an aquaponics system) or species (e.g. mussels or seaweed). Furthermore, such investments also enable aquaculture farmers to interact in different fields of knowledge and gain skills beyond fish farming, for example in engineering and agriculture. Other technological investments can support aquaculture facilities to become more energy

[37] FAO. 2015. Fisheries operations. Best practices to improve safety at sea in the fisheries sector. FAO Technical Guidelines for Responsible Fisheries. No. 1, Suppl. 3.Rome. 196 pp.
[38] Irish Annual Implementation Report for the EMFF (2018). p.6, 9, 10, 84
[39] Irish Annual Implementation Report for the EMFF (2017). p.8
[40] EU project 'Piatra Doamnei' trout farm in Romania https://ec.europa.eu/budget/euprojects/project/f704b0010d594f6390fc4908e733eadd_en?page=2&view=list&hash=35643733653762653032386263
[41] EU project 'Lovlund' aquaculture farm in Denmark https://ec.europa.eu/budget/euprojects/project/b3a5ed3848585fad0bf3eff9f4c4c130_en?hash=35656365366464646338633565

sustainable. For example, it can help install solar panels on buildings where the leftover energy generated can be sold, further diversifying a farmer's income.

The Farm to Fork Strategy emphasises the potential for algae production in the EU and the need to invest in this industry. Algae are fast growing organisms that fix atmospheric carbon, converting it into biomass. They are more efficient than most productive crops and can have numerous applications including the production of feed, food, pharmaceuticals, cosmetics, biofertilizers, and biofuels, among others. If done well, algae production (in particular closed systems) can play an important role in the green recovery. For example, microalgae can provide an important direct or indirect feed source for early developmental stages of many farmed finfish, shellfish and invertebrate species. Although such a solution is highly dependent on regulatory changes to ensure wild caught feed is not used in aquaculture fish farming, supporting the development of these types of solutions can help the aquaculture industry become more sustainable. However, just like with any other type of aquaculture, algae production needs to be in line with environmental legislation including taking into account the sensitivity of flora and fauna to this type of activity.

Although many types of seafood farms that are currently in operation are having detrimental effects on nature conservation, if done correctly, seafood farming can also go hand in hand with nature conservation, in particular through wetland restoration and freshwater fish farming. For example, the Veta La Palma fish farm (113 Km2 estate) is a network of shallow ponds and marshland that hosts 250 different species of birds. It produces 1,500 tons of annual harvest of species such as sea bass, sea bream, sole and shrimp.[42]

Pollution-free seas and ocean

Seas and ocean are impacted by a wide range of pollution types, coming mostly from land-based sources but also from sea-based sources, including: litter (mostly plastics), chemical pollution from industrial and household wastewaters, agricultural pollution and underwater noise pollution. In addition, a number of activities based at sea are major greenhouse gas emitters, such as shipping and offshore oil and gas production, and other extractive industries, such as sand dredging and deep seabed mining, have very harmful impacts on marine ecosystems. These activities form part of an unsustainable consumption and production way of life that causes pollution, destroys biodiversity and contributes to climate change.

Stopping pollution at source is an example of a win-win investment. Creating and deploying the technological and social innovations that are needed will require financial investments but will lead to job and wealth creation. More importantly, it will help transform our society from a polluting and wasteful one to one, which reduces its emissions and absolute resource use, increases resource efficiency and prevents leakages of pollution into the sea.

1. Turning off the tap of plastic pollution

Plastic marine pollution generated by the release of macro and microplastics into the open environment for the past 70 years has become a global concern. Environmental impacts on the ocean are wide, both affecting wildlife (by entanglement, poisoning or starvation) and the health of marine

[42] Walton, M. E. M., et al. "A model for the future: Ecosystem services provided by the aquaculture activities of Veta la Palma, Southern Spain." *Aquaculture* 448 (2015): 382-390.

ecosystems through the release of hazardous substances and interference with natural processes of photosynthesis and oxygen levels.[43]

A resource intensive and mass-consumption based economic model is at the root of the problem and its exponential increase. The Single-Use Plastics Directive was a first step in the right direction towards a more resource-efficient and circular economy. Despite recent attempts by the industry to postpone or weaken the newly adopted legislation[44], investments are urgently needed to shift from the single-use model.

In order to foster new consumption and production models, it will be key to invest in the prevention of single-use plastic waste by scaling-up and mainstreaming already existing and effective activities. This can be done under the form of loans or fiscal incentives for small medium enterprises (SMEs) of the reuse/ rental/ refill sector which can offer alternatives to single-use plastic (SUP) and single use packaging. This can maximise job creation in new business models such as Recup[45], Re-circle[46] companies, which works as a rental, collection and refill service for take-away food containers in supermarkets – or eco-friendly supermarket models such as Original Unverpackt[47].

In Finland, RePack established the possibility for online retailers to take part in a re-packaging scheme that allows customers to return their empty packaging which can then be reused. The feasibility study to take the approach beyond Finland cost approximately €72,000.[48] The company has now been able to expand to other EU countries and has recently established in North America.

Other forms of microplastic pollution for the oceans is synthetic textile fibres, which are the second largest source of microplastic pollution (after tyre dust). Research to reduce the release of microplastics from synthetic fibres should be encouraged and incentives to change business models from non-intensive natural fibres should be promoted. Nevertheless, technological investment can also be supported to reduce microplastics from entering the sea. For instance, investment opportunities could target SMEs to increase and develop research and innovation for projects on retention filters for microfibres to be used in industrial washing machines.

2. Towards clean shipping

Maritime shipping transports around 90% of the world's cargo, contributing significantly to global CO2 emissions and other air pollutants. Greenhouse gas (GHG) emissions from international shipping are approximately 2-3% of all GHG emissions, equivalent to the total GHG emissions of Germany or Japan, and are projected to grow quickly in the years ahead. Ships also contribute to global heating because of emissions of Black Carbon, otherwise known as soot. In 2009, the Commission's Communication with recommendations on the maritime transport sector set a long-term goal of zero waste and zero emissions. However, these targets are far from being achieved.

The most effective method to reduce ship emissions steeply in the short-term is to slow ships down. This will reduce all forms of pollution that are related to fuel burn (Sulphur Oxide, Nitrogen Oxide,

[43] GESAMP (2016). "Sources, fate and effects of microplastics in the marine environment: part two of a global assessment" (Kershaw, P.J., and Rochman, C.M., eds). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 93, 220 p

[44] https://seas-at-risk.org/1058-plastics-industry-uses-faulty-covid-arguments-to-undermine-single-use-plastic-legislation.html

[45] https://recup.de/

[46] https://www.recircle.ch/fr/

[47] https://original-unverpackt.de/

[48] https://cordis.europa.eu/project/id/671852

Particulate Matter including Black Carbon) while also massively reducing underwater noise pollution and the risk of fatal collisions between ships and whales.[49] Reduced speeds increase the number of ships needed to transport the same amount of goods, but even considering this it is still the most effective tool for short-term emission reduction. The social benefits of slower ship speeds are considerable with additional employment created in the building, manning and management of the extra ships.

Black Carbon (BC) is the second most important shipping climate pollutant after CO2 and is a particular threat to the Arctic. A ban on the use of heavy fuel oil (HFO) in Arctic waters would be a valuable investment, significantly reducing BC emissions and having the important co-benefit of eliminating the risk of a HFO oil spill in an area where clean-up is almost impossible and impacts are disastrous for Arctic ecosystems and indigenous peoples. A switch to lighter fuels will allow the use of efficient particulate filters and reduce black carbon emissions by over 90%.

The above immediate actions will significantly reduce shipping's climate impact in the short-term, and should be supplemented by support for sustainable "cold-ironing" in ports and the retrofit of technologies to further improve the energy efficiency of existing vessels. However, to meet the Paris Agreement goals and keep global heating below dangerous levels, all new ships launched after 2030 will need to be zero-emission. Financial investment is needed for the rollout of alternative zero-carbon fuels and propulsion technologies. Several European companies, including SMEs, are already involved in this space and any future recovery plan should support them. Some vessels are turning to liquefied natural gas (LNG) as a cleaner fuel. However, LNG is still a fossil fuel that has lifecycle GHG emissions similar or worse than traditional marine fuels[50] and should not be the subject of financial support.

The EU Biodiversity Strategy for 2030 clearly identifies the challenge of reducing underwater noise. In addition to reduce ship speeds, investing in the retrofitting of ship quieting technologies, including new propellers, could be part of the action plan to reduce underwater noise in Europe. Shipping also needs to address the problems of unregulated discharges of grey water, including microplastics, and of containers lost at sea, with hundreds lost each year. Investment in the traceability, recovery, and transparent and systematic declaration of container losses (perhaps using the example of Monitoring, Reporting and Verification for GHG emissions as a basis), would significantly reduce impacts. Finally, investments should also find solutions to prevent the transfer of invasive species transported in ships' ballast waters, the effects of which are estimated at USD 100 billion a year.[51]

3. Phasing out agricultural, industrial and household wastewater pollution

Activities on land have a great impact on water quality at sea. Intensive agriculture, non-treated sewage, and effluents from industry, as well as urban run-off pollute the sea and cause an excess in nutrients and of toxic substances. In 40% of assessed sites in Europe, nutrient levels exceed threshold values.[52]

[49] https://seas-at-risk.org/images/pdf/publications/Multi_issue_speed_report.pdf
[50] https://theicct.org/publications/climate-impacts-LNG-marine-fuel-2020
[51] Hudson, A. and Glemarec, Y., 2012. Catalysing ocean finance Volume I Transforming markets to restore and protect the global ocean. *UNDP-GEF, New York City, USA*.
[52] SOER 2020, EEA, p 140.

Excess nutrients in the water from agriculture lead to eutrophication and the creation of 'dead zones' in the sea. Chemical water pollution negatively impacts the aquatic environment and contaminates seafood. Health consequences range from eye infections, reduced fertility, disrupted growth, cancer and less efficient immune systems.

To decrease excess nutrient and toxic substances, regulatory changes in for example the Common Agricultural Policy is needed, as well as better enforcement of existing legislation, in particular the Water Framework Directive. Nevertheless, financial investments would also help reduce water pollution through greening urban areas, the research and development of capture systems of microplastics in wastewater treatment plans, eco-schemes that improve sustainable agriculture food production, and nature-based solutions to cut the use of pesticides and biocides.

In France, organic farms employ on average 2.41 AWU (Annual Work Unit) instead of 1.52 AWU in conventional agriculture, and have 59% higher employment content compared to the conventional sector.[53] In Ireland, it costs €220 to €300 on average per hectare per year, meaning that for an average farm size of 43 ha in Ireland, conversion to organic farming would cost €9,640 to 12,900 per year.[54]

4. Offshore energy production

The use of fossil fuels has brought the world to the current ecological crisis where climate change will inevitably have a multiplier effect on marine ecosystems. In addition to its massive contribution to climate breakdown, offshore oil and gas exploration and exploitation have major impacts on marine ecosystems, ranging from the risk of oil spills and the release of toxic chemicals from drilling muds, to underwater noise pollution, especially during the seismic surveys and testing phase that precedes exploitation.

European tourism and fishing industries employ 40 times more people than offshore oil and gas activities (2,570,000 vs 63,000 people in 2017) and generate five times more added value (€85 billion vs €17 billion in 2017)[55]. The offshore drilling industry's economic contribution is small compared to the value added by the sectors it threatens most.[56] Therefore, phasing-out this costly and dangerous activity and switching to renewable energy should be a priority for the EU.

Renewable energy will generate jobs both in the short and in long run.[57] Constructing renewable energy infrastructure can be very labour intensive in the early stages – one model suggests that for every one million dollars spent 7.49 full-time jobs in renewables infrastructure is generated, 7.72 in energy efficiency, but only 2.65 in fossil fuels.[58]

The EU Green Deal emphasises the need for this transition, but this means investing in a smart grid system that is prepared for zero-carbon renewable energy. The EU should also provide the sector with consistent policies and incentives that can encourage private investment to move from small

[53] Agence pour le Développement et la Promotion de l'Agriculture Biologique. L'agriculture biologique, un accélérateur économique, à la résonnance sociale et sociétale. (2018)
[54] Organic Farming, A Step-by-Step Guide to Conversion. Teagasc (2020).
[55] European Commission, 2019. The EU blue economy report. European Commission.
[56] EFTEC 2019. Economic impacts of the exploitation of hydrocarbonsin Greece.
[57] Blyth, Will, et al. "Low carbon jobs: The evidence for net job creation from policy support for energy efficiency and renewable energy." London: UK Energy Research Centre (2014).
[58] Garrett-Peltier, Heidi. "Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model." Economic Modelling 61 (2017): 439-447.

prototypes to pilot plants. These public investments offer high returns by driving down costs of the renewable energy transition.[59]

It is fundamental, however, that the production of renewable energy is not just climate-friendly but also biodiversity-friendly. Investments should be generally directed to renewable energy developments, which do not harm marine biodiversity. Renewable energy must be planned in a way that takes into account the ecosystem and be safeguarded by a process that includes independent, robust, comprehensive and transparent assessments prior to approval. Investments must be made on analysing and evaluating data, which informs how to use marine space in an ecosystem-based approach, looking at all spatial threats - not just energy production. This includes dealing with the cumulative impacts of different human activities including fishing, aquaculture, shipping, and tourism. One project to determine the sensitivity of one taxa (e.g. seabirds) for one threat (e.g. energy production) in one sea basin is estimated at €300,000.[60]

The development of offshore wind farms can have numerous negative impacts on for example seabirds, migratory species and sensitive habitats and species. For example, pile-driving during the construction of offshore wind power plants produces high levels of impulsive underwater noise that can in turn harm many cetacean, fish and invertebrate species.[61] It is essential that investments are directed at developing and deploying best available technologies and best environmental practises that will mitigate negative impacts on biodiversity i.e. by reducing noise levels to leave marine life unharmed. Such approach has already been proven successful in stimulating the development of alternative foundations (e.g. gravity-based or bucket foundations), floating wind-turbines, alternative piling techniques and sound reduction measures such as bubble curtains and cofferdams.[62]

5. Responsible production and use of metals

The growing global demand for the use of metals, driven by e.g. digitisation, the transition to renewable energy, electric mobility and urbanisations, is rapidly increasing the commercial interest in deep-sea mining. Security of supply is also an important factor: many land reserves for metals are in countries with difficult political regimes.

Potential deep-sea mining sites are situated between 1000 and 6000m below the ocean surface, often in highly vulnerable ecosystems and biodiversity hotspots. Scientists warn that deep-sea mining may lead to significant and irreversible biodiversity loss. Actual mining has not started yet: environmental regulation is still in the making. In the meantime, over a million square kilometres is already licenced for exploration in the Pacific, Indian and Atlantic Oceans.

The EU Biodiversity Strategy 2030 calls for a moratorium on deep seabed mining until “the effects of deep-sea mining on the marine environment, biodiversity and human activities have been

[59] Henbest, Seb. "The first phase of the transition is about electricity, not primary energy." Energy News 38.1 (2020): 6.
[60] Estimated on the basis of EU project that mapped sensitivity of seabirds to oil spills in 3 countries (https://ec.europa.eu/echo/funding-evaluations/financing-civil-protection-europe/selected-projects/mapping-bird-sensitivity_en)
[61] HELCOM, 2019. Underwater noise during impact pile-driving: Influencing factors on impulsiveness noise and technical options for complying with thresholds at activity level. Outcome of PRESSURE 9-2018, par. 5.5
[62] https://www.cms.int/sites/default/files/document/cms_cop13_inf.9_noise-bat-bep_e.pdf

sufficiently researched, the risks are understood and the technologies and operational practices are able to demonstrate no serious harm to the environment, in line with the precautionary principle".

Investments into alternative sources are therefore needed for the responsible production and use of minerals and metals. This entails developing and deploying solutions to reduce demand for primary metals, transition to a resource efficient, closed-loop materials circular economy, transition to smart energy and mobility systems, adopt responsible terrestrial mining practices, and adopt structural changes in consumption patterns and lifestyles. In addition, fundamental and independent research is needed to understand the role of the deep-sea ecosystems in areas such as climate change mitigation and the recovery of marine biodiversity.

The hurdle: shifting from harmful subsidies to green investments

This recovery period is an opportunity to rethink how the EU enacts subsidy policies, in particular to redirect what is harmful to green investment opportunities. Subsidies are often aimed at directly supporting income, or at lowering capital or operating costs. By their very nature, they place the recipient outside normal economic market conditions. While some aid is considered beneficial or necessary to help support the transition of a sector towards becoming low-impact and environmentally sustainable, many types of aid have counterproductive or even harmful effects. Spending available funds for harmful measures prevents expenditure from being directed towards other measures, which are considered necessary to ensure the environmental, economic and social sustainability of the sector. While the European Union has set ambitious environmental objectives, many regulatory measures still allow the granting of harmful aid. There is an urgent need for EU policies to be aligned and consistently oriented towards the same objectives.

In the fisheries sector, certain forms of subsidies that lower capital costs, including vessel construction and modernisation, or operating costs help drive the depletion of fish stocks by fishing beyond sustainable limits because they provide economic incentives for fishing - even when it is not profitable. Subsidies can also lead to overcapacity, which undermines best efforts to fish sustainably and limit bycatch and habitat destruction. Capacity and effort enhancing subsidies thus most directly cause resource-depleting production distortions: by lowering the fixed costs of productive capital, and by lowering the variable costs of production itself.

Harmful subsidies incentivise fishers to continue using environmentally destructive fishing practices, travel further to increase their catch, stay at sea longer, and have greater capacity than they would have otherwise, just to name a few examples. Furthermore, there is a weak link between harmful subsidies and improving the living standard of fishers, since a large share of money goes to non-fishers such as suppliers and vessel owners instead of increasing the income of fishers.[63] Overall, capacity and effort-enhancing subsidies are decreasing fisheries productivity, encouraging overfishing and threatening livelihoods in coastal communities.

Fisheries economists[64] consider eliminating or re-directing harmful subsidies as a crucial step for the economic, social, and environmental medium to long-term viability of the sector. At international level, eliminating harmful fisheries subsidies by 2020 is also a major target to achieve the UN's

[63] OECD (2017). Support to fisheries: Levels and impacts. OECD Food, Agriculture and Fisheries Papers, No. 103, Paris: OECD Publishing. Retrieved from: https://www.oecd.org/tad/fisheries/support-to-fisheries.pdf

[64] See, for example: Sumaila, U. Rashid, et al. "Updated estimates and analysis of global fisheries subsidies." Marine Policy 109 (2019): 103695; or Andrés M. Cisneros-Montemayor et al. Strategies and rationale for fishery subsidy reform. Marine Policy 69, 229–236. 2016

Sustainable Development Goal (SDG) on the conservation and sustainable use of oceans, seas and marine resources[65]. Furthermore, at the World Trade Organization (WTO), multilateral negotiations have been ongoing for two decades to reach an agreement for eliminating those subsidies in fisheries[66]. Negotiations have re-gained momentum following the adoption of the SDGs and WTO members have made a commitment to fulfil SDG target 14.6 by adopting an agreement to discipline harmful fisheries subsidies by the end of 2020. Governments around the world spend an estimated 35 billion dollars on fisheries subsidies annually. Of that, over 22 billion dollars was spent in 2018 on capacity-enhancing —or harmful—subsidies.[67]

It is estimated that in 2018, the EU provided over two billion dollars in capacity-enhancing subsidies.[68] Redirecting these public resources to nature restoration and conservation, transitioning to sustainable and low impact seafood, and tackling pollution will both create sustainable jobs in those sectors and enhance environmental status, and remove significant perverse incentives that lead to the erosion of the natural resource base that underpins Europe's maritime and coastal economies. At European level, the elimination or redirection of subsidies harmful to biodiversity must take place both with respect to the reform of sector specific policies (such as the European Maritime and Fisheries Fund) as well as horizontal legal instruments (such as the Energy Taxation Directive 2003/96/EC).

For instance, the removal of the fuel tax exemption for fisheries would not only increase tax revenues, but also create an incentive for lower impact fishing - making fuel-intensive and destructive practices uneconomical, and providing an incentive for the development of new gears, more selectivity, and innovative technologies, resulting in lower ecosystem impacts and lower GHG emissions.[69]

[65] https://www.un.org/sustainabledevelopment/oceans/
[66] https://www.wto.org/english/tratop_e/rulesneg_e/fish_e/fish_e.htm
[67] Sumaila, R. et al. Updated estimates and analysis of global fisheries subsidies. Marine Policy 109 (2019) 103695. https://doi.org/10.1016/j.marpol.2019.103695
[68] Sumaila, U. Rashid, et al. "Updated estimates and analysis of global fisheries subsidies." Marine Policy 109 (2019): 103695
[69] Griffin Carpenter and Charles Millar: "Fisheries management costs: How the expense of Scottish fisheries management can be sustainably funded", 2018, p.7.

Why financial support for fuel does more harm than good:

Subsidies that reduce the cost of fishing through financial support for fuel, gear, or bait, are the most likely to increase both legal and illicit fishing effort, potentially leading to stock depletion.[70] Fuel subsidies can largely be described as the price differential between public costs for fuel and the price paid by fishers. In Europe, financial support for fuel is mostly provided in the form of fuel tax exemptions, also benefiting the fisheries sector, although it could also include other types of state aid and support schemes that support fuel expenses of fishers indirectly.

By reducing operating costs and thus enhancing fishing effort, direct or indirect fuel subsidies are increasing the fishing pressure on the target and non-target species (e.g. bycatch) and therefore contribute to the overexploitation of EU fisheries.

This both harms biodiversity, marine habitats, and the ecosystem structure and causes further depletion of fish stocks, but also supports economically unprofitable practices and undermines future economic benefits. Furthermore, the adverse impact of financial support for fuel arises indirectly through the promotion of inefficient and polluting modes of transport and increased carbon dioxide emissions contributing to climate change. It leads to competitive distortion within fleets and industrial sectors.

According to the Commission, this type of sector-specific energy tax exemptions or reductions substantially weakens the incentives to invest in more energy-efficient capital stock and production processes in these sectors and even constitute a burden for other sectors and/or private households that have to make up the revenue shortfalls triggered by them.[71]

By artificially keeping the resource rent positive, governments' financial support for fuel makes it possible to keep uncompetitive fishing enterprises afloat. However, in the long term, by threatening the health of marine ecosystems, they would lead to negative resource rent and negative social impacts for coastal communities that depend on marine resources for their livelihoods and income.

The social and economic importance of investing for the marine environment

Oceans cover almost three-quarters of the planet, yet we are only just beginning to discover the true extent of these ecosystems and their impacts on our lives. Despite our limited understanding, according to some estimates the marine environment provides up to two-thirds of the ecosystem services provided by the planet's natural capital.[72]

The marine environment in EU waters includes a vast and diverse area that is rich in resources, both biotic and abiotic. In 2017, the sectors of the EU Blue Economy directly employed over four million

[70] Martini, R. and Innes, J. "Relative Effects of Fisheries Support Policies", OECD Food, Agriculture and Fisheries Papers No. 115. 2018

[71] Communication from the Commission to the European Parliament, the European Council and the Council: "A more efficient and democratic decision making in EU energy and climate policy", COM(2019) 177 final.

[72] The Economics of Ecosystems & Biodiversity, 2012. Why value the oceans? A discussion paper. The Economics of Ecosystems & Biodiversity.

people (equivalent to 1.8% of the EU total) and generated €180 billion of gross value added (i.e. 1.3% of the EU total).[73] Blue economy sectors range from coastal tourism, to energy generation, to capture fisheries and aquaculture.

The social and economic importance of the marine environment extends well beyond the sectors working directly in the blue economy. The EU's coastal regions are home to 214 million people (45% of the population) and generate €6.2 trillion in EU GDP (43% of the total).[74] For these populations the COVID-19 crisis highlighted the significant social importance of the marine environment in providing access to nature for exercise, calmness, and respite. Natural environments are key to providing restorative experiences and coastal environments are particularly good.[75]

Research has shown that living near the coast also boosts both physical[76] and mental health[77] and this effect is particularly strong for the lowest-earning households. According to over one million responses from the mobile phone app 'Mappiness' that pings users at random moments, out of all geographies people were happiest in 'marine and coastal margins'.[78]

We know that the marine environment, and therefore the blue economy that depends on it, is particularly vulnerable. While there is already an active blue economy, the marine environment is still a 'frontier' of new and increasing human impacts. Marine litter already costs €11 billion a year and coastal flooding from climate change is projected to surpass these costs and affect between 500,000 and 740,000 EU citizens.[79]

In some Member States, coastal areas are defined by higher degrees of economic deprivation, unemployment, and business insolvency, and lower levels of income and education.[80,81,82] Poor transport linkages and an aging population further these trends. With a sharp decline in tourism, resulting from COVID-19, the blue economy looks particularly vulnerable.

We also know that there is great potential in green recovery where investments deliver a healthier environment and a healthier economy. In April 2020, University of Oxford economists surveyed 231 finance ministry officials, central bank officials, and other economists, representing 53 countries including all G20 nations, to ascertain their perspectives on COVID-19 fiscal recovery packages for both their ability to stimulate the economy and their ability to mitigate climate change. Fortunately, the results showed that there was no trade-off between 'greenness' and economic recovery - indeed

[73] European Commission, 2019. The EU blue economy report. European Commission.
[74] Ibid.
[75] White, Mathew P., et al. "Coastal proximity, health and well-being: results from a longitudinal panel survey." *Health & place* 23 (2013): 97-103.
[76] Wheeler, B.W., White, M., Stahl-Timmins, W., & Depledge, M., 2012. Does living by the coast improve health and wellbeing? Health & Place 18 (5)
[77] Garrett, J.K. et al. 2019. Coastal proximity and mental health among urban adults in England: The moderating effect of household income. Health & Place 59.
[78] MacKerron, G. & Mourato, S., 2013. Happiness is greater in natural environments. Global Environmental Change 23 (5), pp. 992-1000.
[79] European Commission, 2019. The EU blue economy report. European Commission.
[80] Balata, F. & Vardakoulias, O., 2016. Turning back to the sea: A Blue New Deal to revitalise coastal communities. New Economics Foundation.
[81] Balata, F. & Carpenter, G., 2018. Coastal communities in the UK: a vision for starting up, not shutting down. New Economics Foundation.
[82] Depledge, M. et al. Future of the Sea: Health and Wellbeing of Coastal Communities. Government Office for Science.

the two were positively correlated. Of the 25 policies considered, the two top ranked policies are clean research and development spending, and clean energy infrastructure investment[83.]

Investments in the marine environment can yield particularly large returns. According to the UK Government's Natural Capital Committee (NCC), the marine environment has the largest potential value that could be generated by improving the quality to policy targets.[84] These changes are not only large in scale but also give a good return. The NCC also found that investments in the marine environment have some of the highest benefit cost ratios.[85]

Fortunately, many of these natural investments are easy and can come about 'naturally'. If these investment opportunities are seized, and the harmful disinvestments and barriers avoided, the social and environmental importance of the marine environment can be enhanced for millions of Europeans.

Conclusion

The lesson learned from the COVID-19 crisis is that early action is essential, which is true for any crisis. The biodiversity and climate crises and the need to rebuild the EU's economy go hand in hand. There is no reason not to invest in a green future for the ocean. Following the EU Green Deal, the Biodiversity Strategy and the Farm to Fork Strategy, future financial commitments must continue to build on this momentum and walk the walk of this political agenda.
If green goals are the motor for the recovery, then the EU will have to direct harmful financial incentives and subsidies to green investment opportunities. Every euro spent needs to ensure that these green investment opportunities can have a multiplier effect.

[83] Hepburn, C., O'Callaghan, B.,Stern, N., Stiglitz, J. & Zenghelis, D., 2020. Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change? University of Oxford.
[84] Natural Capital Committee, 2014. The state of natural capital: Restoring our natural assets. Natural Capital Committee.
[85] Natural Capital Committee, 2015. The state of natural capital: Protecting and improving natural capital for prosperity and wellbeing. Natural Capital Committee.