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VIEWPOINT

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The forgotten ocean: Why COP26 must call for vastly greater ambition and urgency to address ocean change

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Abstract

1. Of all the interconnected threats facing the planet, the top two are the climate and the biodiversity crises. Neither problem will be solved if we ignore the ocean. To turn the tide in favour of humanity and a habitable planet, we need to recognize and better value the fundamental role that the ocean plays in the earth system, and prioritize the urgent action needed to heal and protect the ocean at the 'Earthscape' level – the planetary scale at which processes to support life operate.
2. The countries gathering at COP26 have unparalleled political capacity and leadership to make this happen. COP26 could be the turning point, but there must be commitment to united action for the ocean, as well as planning to meet those commitments, based on science-led solutions that address the interconnectivity of the ocean, climate, and biodiversity.

3. Key ways in which the ocean both contributes to and acts as the major buffer for climate change are summarized, focusing on temperature, but not forgetting the role of storing carbon. It is noted with 'high confidence' that the ocean has stored 91% of the excess heat from global warming, with land, melting ice, and the atmosphere only taking up approximately 5, 3, and 1%, respectively.
4. We also highlight the impact of the recent large release of heat from the ocean to the atmosphere during the 2015–2016 El Niño. We then present six science-based policy actions that form a recovery stimulus package for people, climate, nature, and the planet. Our proposals highlight what is needed to view, value, and treat the planet, including the ocean, for the benefit and future of all life.

KEYWORDS
climate change, COP, management action, ocean conservation, protection

1 | INTRODUCTION

In November 2021, the world will gather in Glasgow, Scotland, for the Conference of Parties to the United Nations Convention on Climate Change (COP26), a meeting many believe to be the world's best and last chance to get runaway climate change under control. Hosted by the UK and Italy, this meeting comes after three decades of United Nations action on climate, bringing together almost every country on Earth in climate summits, and transforming climate change from a fringe issue into an urgent global priority. Despite these summits, the rate of climate change is still accelerating ('widespread, rapid and intensifying'; Intergovernmental Panel on Climate Change (IPCC), 2021), largely linked to changes in the ocean, causing a continuing decline in nature and disruption at the planetary scale to the environment, people, and all our futures (Holbrook et al., 2019; Perkins-Kirkpatrick & Lewis, 2020; Cheng et al., 2021; Hugonnet et al., 2021; O'Hara, Frazier & Halpern, 2021; Veng & Andersen, 2021). As the world slowly starts to reopen after the COVID-19 pandemic, governments are signalling a determination to build forward better, greener, and more equitably, with an increased recognition of the need to work together, especially on major global issues such as climate change (e.g. European Commission, 2019). Building forward better must include urgent ocean actions.

To make a difference, it is imperative that we start to stabilize climate and ocean change and prevent any further loss of nature. Repackaging what happened before the COVID-19 pandemic is not building forward better. Climate change was a threat to planetary well-being prior to the pandemic (Steffen et al., 2015), but COVID-19 has since shown the danger of not taking the biodiversity crisis seriously, especially as human expansion and increased exploitation have forced much closer interactions with living organisms (Petrovan et al., 2021), including those living in the ocean. Thus, a more thoughtful and far-sighted, science-led approach must be taken to changing the attitudes that have locked us all into a spiral of decline in the functioning of the Earth's systems.

COP26 will be a critical moment in the fight against climate change that needs to recognize the key role that the ocean plays. The summit also provides a golden opportunity to stimulate global ocean protection and recovery that will help tackle climate disruption, reverse biodiversity loss, support human well-being, and enable the world to embark on a successful recovery from the COVID-19 pandemic (Claudet, 2021). It is regrettable that governments across the decades have persistently failed to meet the targets that they have agreed: for example, none of the 20 Aichi biodiversity targets set in 2010 were met in full in 2020 (https://www.cbd.int/gbo5). A significant shift in approaches to implementation will be required, learning from successful examples such as the recovery of the ozone layer of the stratosphere and the climate change co-benefits achieved through the Montreal Protocol (Young et al., 2021). Against this positive outcome, however, some countries have continued to manufacture and emit chlorofluorocarbons (CFCs) and other halogens in contravention of the Montreal Protocol (Solomon, Alcamo & Ravishankara, 2020), and the first appearance of ozone mini holes occurred in the Arctic in the winter of 2019–2020, with the largest hole situated over the UK and western Europe in December 2019 (Kuttippurath et al., 2021). Furthermore, the record ozone hole over Antarctica in the 2020 southern winter is currently (28 September 2021) even bigger: larger than the whole of Antarctica, although with a slightly higher ozone minimum (https://ozonewatch.gsfc.nasa.gov/, accessed 1 October 2021).

Pictured from space the Earth truly is a blue planet, and although the challenges before all of us relate to land, fresh water, atmosphere, and ocean, up to now the ocean has been largely forgotten or ignored in forming solutions for climate change and the future; hence the focus of this article. Here, we first highlight the need for a much greater understanding of the essential role that the ocean has played in buffering climate change, focusing on temperature, including jumps in global surface temperature when the ocean releases heat back into the atmosphere. Six science-based policy actions are presented that form a recovery stimulus package for people, climate, nature, and the planet formulated by scientists of the International Programme on the State of the Ocean (IPSO). These proposals highlight what is needed to view, value, and treat the planet, including the ocean, for the benefit and future of all life.

2 | WHY IT IS CRITICAL TO FULLY RECOGNIZE THE KEY ROLE THAT THE OCEAN HAS PLAYED IN MITIGATING THE CONSEQUENCES OF CLIMATE CHANGE

The ocean covers over 71% of the surface of the Earth but many people are unaware that it is also one of the predominant controlling factors in the rate of climate change, absorbing over 90% of the excess heat produced (Trenberth, 2020), as well as approximately 38% of the CO_2 generated by human activities (Friedlingstein et al., 2019; Gloege et al., 2021). Whereas land covers some 29% of the surface of the planet but only absorbs about 3% of the heat from global warming, with the atmosphere absorbing even less (Trenberth, 2020). The ocean is taking the brunt of the extra burden of regulating the planet's increasing temperature resulting from anthropogenic GHG emissions, alongside its role as a carbon sink, thus ensuring that the Earth continues to be habitable. An accelerating increase in both the ocean heat content (OHC) and the sea surface temperature (SST) as a result of global warming is contributing to a range of increasing impacts at the Earthscape level. Ocean heat is supercharging tropical cyclones and hurricanes, intensifying the hydrological cycle leading to greater and more intense precipitation events, stronger wind speeds, an increase in the size of storms, and possibly a reduction in their tracking speed (see supporting information in Laffoley et al., 2020). Consequently, the number of natural disasters, their intensity and financial cost, and the stress to people, governments, and insurers has grown (https://ourworldindata.org/natural-disasters).

Ocean stratification is intensifying, primarily as a result of higher temperatures, but with a contribution from increased rainfall, which reduces the salinity of the upper layers. Evidence from many parts of the world indicates a shoaling (shallowing) of the upper wind mixed layer (Li et al., 2020), which is thought to be a precursor and possible trigger of El Niño (Hasson et al., 2018). Shallow stratification is a feature of the warmest part of the ocean where SSTs are >29 °C, known as the Western Pacific Warm Pool, an effect that has been enhanced by intense precipitation (Qu, Song & Maes, 2014). In the contrasting colder waters of the Southern Ocean, the shoaling of the upper Circumpolar Deep Water is increasing between three and 10 times faster than previously estimated, with major potential consequences for the melting of ice shelves and the scale of sea-level rise (SLR) (Auger et al., 2021). Greater water stability also contributes to the increasing occurrence of marine heatwaves (Holbrook et al., 2019) that can have particularly pronounced impacts on ecosystems: for example, as now observed at the Great Barrier Reef (Dietzel et al., 2020). More stable waters also mean that less CO_2 can be taken up by the ocean because of the increased stratification (Le Quéré & Metzl, 2004) and is a prime cause of increasing areas of low oxygen levels in many parts of the ocean, exacerbating the already present and growing threat from deoxygenation associated with nutrient run-off from land in more coastal regions (Laffoley & Baxter, 2019). Warming has also induced an acceleration in ocean circulation, with substantially intensified warming in major western boundary currents and with an extension towards the poles of ocean gyres, reinforcing the melting of polar ice (Yang et al., 2016; Hu et al., 2020; Yang et al., 2020).

The thermal expansion of sea water as a result of increased heat content is a major contributor to SLR, with Cheng et al. (2021) estimating that the total depth warming since 1960 corresponds to an increase of approximately 47 mm in global sea level (thermosteric sea level). Further thermal and other heat-driven increases in sea level, resulting from melting ice (Grinsted & Christensen, 2021) and reduced storage of water on land (Kuo et al., 2021), are clearly on the horizon and require an urgent adaptation response from coastal communities.

The ocean moderates heating on land in areas adjacent to the sea through evaporation. Further afield in the centre of continents, low water content in the soil and air means that cooling from evaporation is limited. As a result, the land temperature is amplified compared with the ocean (Tyrrell et al., 2015) and the land is warming one and a half times as fast as the ocean (Byrne & O'Gorman, 2018) (1.4–1.7 times, IPCC, 2021). The proximity of anomalously warm SSTs in the North-east Pacific (a mini warm blob) coincided with the extreme air temperatures and forest fires in the Pacific Northwest of America in June–August 2021 as one consequence of high global temperature. In addition, an extreme heatwave of over 50 °C occurred in June in several countries in the Middle East, and in Siberia and eastern Europe (but with lower relative temperatures). Reducing the warming of the ocean is crucial for the future of both marine and terrestrial ecosystems (Beaugrand et al., 2019; Trisos, Merow & Pigot, 2020; O'Hara, Frazier & Halpern, 2021) as well as the survival of humans, animals, and plants in the warmer summer months of continental and tropical regions (Mora et al., 2017).

In El Niño years, the ocean releases large quantities of heat in the tropics, high into the troposphere, with resulting pronounced effects on the weather that in some extreme events causes a sharp increase in regional and global temperatures (Tyrrell et al., 2015; Yin et al., 2018). Pronounced step-like increases in SST and atmospheric temperature occurred around 1986–1987, 1997–1998, and 2015–2016, with knock-on effects. In 1987, this affected all earth systems (Reid et al., 2015) and such episodic effects continue to occur with the latest temperature event being particularly pronounced (Yin et al., 2018; Beaugrand et al., 2019; Jones & Ricketts, 2021; Kuo et al., 2021). The mean jump in global surface temperature over the three years of 2014–2016 was almost a quarter of a degree Celsius (0.24 °C, Yin et al., 2018), with temperatures remaining at a high level since this event and with the global mean sea level 2.5 times higher than in a previous extreme El Niño, 1997–1998, in part through drought and low terrestrial water storage (Kuo et al., 2021). The temperature increases and associated changes led to extreme weather events, reduced carbon uptake, increased fire area, and outbreaks of disease, plus major ecological consequences on land and in the ocean, including the largest and most extensive bleaching of coral reefs ever recorded (Bastos et al., 2018; Claar et al., 2018; Anyamba et al., 2019; Burton et al., 2020). Given how much heat the ocean has already absorbed, any further increased output from or reduced input to the ocean would have a large impact on the rise of atmospheric temperature. At present, we do not fully know the causative factors behind the scale and frequency of major heat release events into the atmosphere triggered by El Niño, but such events are projected to increase in frequency, magnitude, duration, and impact in the future with global warming (Yin et al., 2018).

The world appears to be warming and the sea level is rising at a much faster rate than anticipated (Grinsted & Christensen, 2021; Loeb et al., 2021). The only caveat is that it is not clear if this pattern will continue. The increased pace of change is in part a consequence of increased water content in the atmosphere reinforcing the global warming caused by higher levels of greenhouse gases (GHGs) plus marked reductions in sea ice and cloud cover so that less of the sun's energy is reflected into space. It is unclear at present whether the buffering/mitigation of global surface temperature and the uptake of atmospheric CO_2 by the ocean will continue at the same rate into the future, although the indications are that both will decline as cumulative CO_2 emissions increase (IPCC, 2021). Therefore, a key lesson is that reducing GHGs to stabilize global temperature is not the only factor that has to be considered and that their reduction alone will not reduce global ocean heat content or solve global warming.

2.1 | Scale-up solutions to the Earthscape level: Ambition must match the challenge

Climate change impacts are not equal across the planet, with the countries contributing least to GHG emissions often being the most vulnerable (Thiault et al., 2019), thus increasing global economic inequality (Diffenbaugh & Burke, 2019). Immediate implementation of agreed ambitious cuts in GHG emissions are needed but are insufficient alone to resolve the true scale of the problems we face.

The Earthscape approach referred to in this article recognizes that there is a need to simultaneously address climate change impacts and reduce all cumulative direct and indirect stressors on marine ecosystems, to be achieved through evidence-based, integrated policymaking at the supranational level. This will need enhanced multilateralism, as well as better connected governance, public funding for adaptation, resilience, biodiversity protection, and to address equity issues, and innovative finance to support the recovery of nature on land, in fresh water, and in the ocean, including marine areas beyond national jurisdiction (ABNJ), which make up 40% of the surface of the planet.

There is a growing global ambition to address the challenges of climate change but there is nothing that embeds the protection of the ocean within that ambition. This will require implementation of the current asks of leaders for at least 30% full and effective ocean protection, with the remainder sustainably managed, including via an international treaty to protect marine biodiversity in ABNJ (including the high seas and the international sea bed). We can no longer afford to allow the few organizations and states benefiting from the status quo to delay the necessary actions to safeguard the common good. This must be addressed through ambitious Earth-scale approaches and solutions that stimulate multilevel action in a measurable, transparent, and accountable fashion.

2.2 | Accelerate and integrate the efficacy of climate/biodiversity actions to achieve greater impact and effect

Good progress has been achieved in recognizing issues that hinder nature and climate recovery, with many associated policies and targets. However, the policies are often poorly implemented as they hit economic or social barriers, with siloed thinking that separates biodiversity and climate policy also hampering action and delivery (Pettorelli et al., 2021; Portner et al., 2021; Shin et al., unpubl.).

As of 2021, less than 3% of the global ocean has sufficient protection within marine protected areas (MPAs) to deliver strong conservation benefits (Grorud-Colvert et al., 2021), despite an agreed global target of 10% coverage by 2020. This is in sharp contrast to the at least 30% of the ocean in highly or fully protected MPAs called for by the scientific community (World Parks Congress, 2014). Since the target proposal for at least 30% high or full protection was first discussed in 2003 (Gell & Roberts, 2003), the scientific case in support has strengthened but ocean damage has continued. Given the continued losses in biodiversity and ecosystem services (Díaz et al., 2019), some experts, such as E.O. Wilson, now argue that at least 50%, 'half Earth', protection is needed as a new minimum target (https://www.half-earthproject.org; Dinerstein et al., 2017). To avoid creating 'islands of hope in a sea of despair', there is an urgent need for the delivery of effective management of activities across the whole ocean outside of MPAs to achieve true sustainability. There is broad consensus in the scientific community (Grorud-Colvert et al., 2021) and a growing political understanding (The Blue Leaders, 2021) that by 2030 at least 30% of the global ocean should be within fully or highly protected areas, with the remaining 70% sustainably managed, and with an ambition to achieve 50% overall protection in the following decades.

The carbon cycle links biodiversity and climate. Blue carbon coastal wetlands (i.e. saltmarshes, mangroves, and seagrasses) have high carbon storage rates and sustain diversity. However, huge volumes of carbon are also stored naturally in the open ocean and deep sea, and there is unrealized potential to use MPAs to maintain carbon stocks, support the Paris Agreement, contribute to efforts to reduce maritime nations' emissions, and mitigate the impacts of climate change (Hilmi et al., 2021). A new way of thinking and acting is needed where MPAs are implemented for biodiversity values but also to retain carbon sequestered in natural systems (Roberts et al., 2017).

Solutions for the future lie in a better linkage between policy and action across the land, fresh water, and ocean divide, and in ensuring we think in terms of an ecologically coherent, interconnected network of sites that are established and managed in ways that promote ecological and climate-change resilience, with corridors between sites established across latitudinal ranges that can accommodate species that will need to shift their ranges as a result of climate effects such as a warming ocean. Thus, stationary protected areas must be complemented by wider measures to protect migratory marine life within its current and projected future range (Maxwell et al., 2020; Ortuño Crespo et al., 2020). New thinking, governance, and management systems will be needed to protect ecological space in the ocean, both within and outside the current MPAs, as the distributions of species and environmental quality changes in response to climatic disruption.

Integrating MPA designation and management with the objective of carbon storage is a simple step that many nations could take now by improving communication between government ministries and broadening thinking from single (e.g. biodiversity protection) to multi-objective management measures. Coordinating the implementation of MPA management plans as a core element of climate adaptation and mitigation (as Chile has done in their recent Nationally Determined Contribution: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Chile%20First/Chile%27s_NDC_2020_english.pdf) would improve the way environmental policy is applied, increasing 'value for money' and transparency (Roberts, O'Leary & Hawkins, 2020).

2.3 | Stop support for activities that damage the ocean: redirect incentives to positive outcomes for the planet

One of the most obvious things that can be done to 'build forward better' is to stop financially supporting human activities that are clearly highly damaging to the ocean (Sumaila et al., 2010; Lubchenco et al., 2016). The burden of cost should be reversed so that payments are charged for activities that damage ocean ecosystems. The values of those payments should be set at levels that help to prohibit damaging actions being introduced in the future. It is ironic that humanity knows the many ways to respond to the climate and biodiversity crises but continues to pursue more extractive activities and harmful actions year after year. At the same time governments and insurers bemoan the costs of recovery measures from damage but procrastinate and provide inadequate support for delivering recovery, whilst still subsidizing more damage to occur (e.g. with perverse fishery subsidies).

Science has, for example, already extensively documented the damage that fishing with bottom trawls and dredges causes to marine ecosystems (e.g. Kaiser, 1998; Watling & Norse, 1998). Ocean life is fragile and should not be sacrificed to maximize short-term profits for a small number of companies and countries. As one descends deeper into the ocean, species become increasingly long-lived (e.g. some deep-water coral colonies are over 4,200 years old) (Roark et al., 2009) and are therefore highly vulnerable to the impacts of activities such as deep-sea fisheries (Hall-Spencer, Allain & Fossa, 2002; Norse et al., 2012). The first pass of a net causes the most damage, removing the largest and oldest creatures. This removal is often forever, as recovery is rare or non-existent on human timescales. What science has yet to do is assess the full cost of this damage, in terms of carbon release, loss of future carbon sequestration, and loss of potential medical treatments (e.g. antibiotics) and genetic resources (but see Sala et al., 2021).

To prevent further deterioration, restraint is necessary: all fishery subsidies that contribute to overfishing and illegal, unreported, and unregulated fishing should be stopped (Sumaila, Villasante, et al., 2019). Commercial trawl and dredge fisheries should be banned in all MPAs and in 'vulnerable marine ecosystems' (VMEs) worldwide, as described by the United Nations General Assembly (UNGA, 2007; UNGA, 2009).

Future sources of massive sea-bed disruption, such as deep sea-bed mining, should be prohibited (Niner et al., 2018; Levin, Amon & Lily, 2020). Deep sea-bed mining is too great a risk in an already stressed ocean (Washburn et al., 2019). As with deep-sea bottom trawl fishing, mining threatens highly vulnerable and ancient forms of marine life. Furthermore, sea-bed mining could harm human life by introducing toxins into seafood through discharges of mineral-laden plumes into the water column, thereby undermining the transition to a Sustainable Blue Economy (Drazen et al., 2020; Levin, Amon & Lily, 2020).

Given that transitioning away from fossil fuel use is essential to help solve the climate crisis, there should also be an immediate ban on the granting of new offshore oil and gas exploration and production licences, and a rapid phasing out of current offshore oil and gas extraction. Financial regulators can play an important role here by integrating climate-related risk analysis into financial stability monitoring (Bolton et al., 2020), through implementation of a compulsory sustainable finance taxonomy, such as the one put in place by the European Union Taxonomy Climate Delegated Act (EU, 2021) as well as through their own funding processes.

2.4 | Drive ocean recovery and restoration through enhanced global cooperation and momentum

The latest IPCC report (IPCC, 2021) states that it is unequivocal that human influence has warmed the ocean, resulting in widespread and rapid changes, with further increases in global surface temperature until at least the mid-century under all emissions scenarios. As a result of past and future GHG emissions, such changes are irreversible for centuries to millennia, particularly in relation to the ocean, ice sheets, and global sea level (IPCC, 2021). However, there are still limitations in our understanding on how extreme climatic events affect biological processes, ecosystem functioning, and the capacity for adaptation (Ummenhofer & Meehl, 2017; Pettorelli et al., 2021), and some climate intervention measures, including some nature-based solutions, might even threaten biodiversity (Seddon et al., 2020).

Many carbon-sequestering marine habitats have been decimated by human activity, increasingly exacerbated by extreme weather events. Up to 30% of mangroves have been lost through degradation and deforestation over the last 50 years (Polidoro et al., 2010), with land-use change to aquaculture and agriculture being the major driver (Goldberg et al., 2020). Losses have slowed to an average of 0.13% per year, but with high regional variation (Goldberg et al., 2020). The disturbance and loss of seagrass habitats is much higher (7% per year), which can result in increased carbon emissions (Salinas et al., 2020). Active restoration of marine habitats provides a mechanism to recover marine life that could be achieved over one to three decades (Duarte et al., 2020) for the benefit of people and nature, and to achieve global goals. Mangrove restoration, including the reversion of aquaculture ponds, can restore ecosystem services (Duncan et al., 2016) and meet climate change, biodiversity conservation, and sustainable development objectives (Su, Friess & Gasparatos, 2021). Seagrass restoration is still relatively new, but with an increasing number of successful case studies this has the potential to be scaled-up in significant ways (Tan et al., 2020). The lack of a global inventory of total restored area is a current knowledge gap (Duarte et al., 2020) that could hamper progress in understanding the impact of overall restoration efforts and setting meaningful recovery targets to mitigate climate change.

Initiatives to drive the required ecosystem recovery and restoration need enhanced global cooperation and momentum, a key driver of the UN Decade on Ecosystem Restoration (2021–2030). The COVID-19 pandemic has highlighted our broken relationship with nature (Petrovan et al., 2021) but has brought together governments, scientists, and industry to form new and stronger collaborations. There are important lessons that can be applied from the COVID-19 pandemic to the global climate crisis, including the costs of delay, biases of human judgement, value judgements at the science–policy interface, and the multiple forms of international cooperation required (Klenert et al., 2020). It is increasingly apparent that as global inequality rises as a result of climate change and consequences are felt disproportionately, tackling this effectively and fairly will require a better understanding of social and behavioural drivers such as morals (Lau et al., 2021), ethics, and justice (Byskov et al., 2019). For example, the ‘polluter pays principle’ recognizes environmental and social injustices (Roberts & Parks, 2006), yet must itself be implemented fairly (Zahar, 2020).

Recovery, restoration, mitigation, and intervention policies and actions must have clearly identified objectives and a means to assess both their efficacy and effectiveness. Bold decisions need to be taken now so that present and future generations can benefit progressively. It is urgent as year-on-year the likelihood of a successful outcome, where climate change is halted and ultimately reversed, and the balance of nature is restored, is reduced as greater disruption from climate change and the loss of nature and the services it provides intensifies.

2.5 | Highlight the connection between nature and global economics: Value the ocean's natural capital to invest in all our futures

The recent Dasgupta report for the UK Government (Dasgupta, 2021) demonstrated the need to put nature front and centre in global economics. The natural capital of the ocean is vast and deep, and ocean services are often taken for granted and used for free, with their damage unrecognized and uncompensated (Baker, Ramirez-Llodra & Tyler, 2020). The ocean urgently needs comprehensive natural capital accounting (Bertram et al., 2021) and imaginative and effective funding and financing mechanisms to support ocean biodiversity and climate action by all nations (Thiele & Gerber, 2017; Sumaila et al., 2020). Crucially, in an age of global connectivity (Arvis & Shepherd, 2013), everyone must work together to ensure that a sustainable blue economy based on the Sustainable Blue Economy Finance Principles (United Nations Environment Programme Finance Initiative (UNEP-FI), 2020) not only prevents any further damage and destruction of ecosystems and underlying services, but also restores and improves ocean health locally and globally. Nature-based solutions require new integrated, equitable, and just finance and insurance mechanisms that support the biosphere, including people (Miller et al., 2016; Deutz et al., 2020).

A greater awareness of the importance of a healthy ocean to human welfare is needed to help support the financing of ocean action (Fleming et al., 2021). As only an estimated 1% of the contribution of economic impact is devoted to protecting the ocean currently (Sumaila et al., 2021), there is an urgent need to increase the public funding of adaptation, resilience, and biodiversity targets, as well as the overall support for the uptake of nature-based solutions in infrastructure finance (Thiele et al., 2020). The present funding gap is not only a result of a lack of understanding of the ecosystem service values of the ocean (Austen et al., 2019) or the poor financing of ocean services themselves (Sumaila et al., 2021), but there is also need to improve our understanding and appreciation of values and benefits other than in strictly monetary terms when considering priorities and weighing up trade-offs (Allison et al., 2020). The reward for action should not simply be measured in terms of financial benefit but also in less tangible and more important services, such as global resilience, human well-being, and sustainability.

The emerging regulatory architecture for financing a more sustainable world includes the Net Zero Investment Framework (Institutional Investors Group on Climate Change (IIGCC), 2021) and the broader green, climate, and transition finance approach (EU, 2020). This now needs to be urgently supplemented with a nature-based risk assessment process that ensures net biodiversity positive outcomes and fully includes marine ecosystems and effective protection and management of the ocean. The Taskforce for Nature-related Disclosures (TFND, 2021) provides an important opportunity to deliver a framework for mandatory disclosures and should include marine ecosystem impacts from the start.

Facilitating private-sector engagement, and innovative finance for conservation, ocean risk management, and blue natural capital will be key to addressing the global-scale biodiversity investment challenge. The Finance in Common Declaration (2020) of the leading public development banks rightly commits them to ocean funding and post-2020 United Nations Convention on Biological Diversity (CBD) alignment. These ambitions need to be translated into quantifiable goals and action to be fully implemented in this decade. COP26 is a major opportunity to make this happen.

2.6 | Deliver the science we need for a healthy, productive, and resilient ocean that benefits people and inspires humankind as a whole

Underpinning the previous five imperatives is the need to continually improve the science on which decisions are made, and to broaden engagement within the global community to contribute to both knowledge creation and how such knowledge is applied to management (Claudet et al., 2020; Bennett et al., 2021). This science needs to proceed in a transdisciplinary way (e.g. Syddall, Thrush & Fisher, 2021) and target actions that are effective and fair. Most importantly, we must better understand the needs and priorities of ocean-dependent peoples and evaluate potential solutions for them (Singh et al., 2021). This includes recognizing the need to integrate climate, fisheries, and food policies for those most vulnerable to food and nutrition insecurity (Maire et al., 2021). At the same time, we need to better communicate the diversity of knowledge we already have (e.g. indigenous, scientific, and traditional knowledge), show what the problems are, and find the transformative paths needed to address them today to safeguard our future.

To keep pace with accelerating ocean change and the cumulative effects of stressors, we must constantly improve our understanding of ocean processes and rapidly translate these findings and other forms of knowledge into informed decision making, based both on precautionary and proactive initiatives. We also need to ensure that these efforts are inclusive, open, just, and foster partnerships, capacity, and connections at all scales.

The United Nations Decade of Ocean Science for Sustainable Development, or 'UN Ocean Decade' (https://oceandecade.org) provides a vital opportunity for all the nations of the world to join forces to better understand ocean change, its implications for humanity and ocean life, and to foster informed decision making and action around the globe. Together, nations have a great capacity and, with it, the responsibility to champion this global effort.

The UN Ocean Decade provides a broad platform to bolster scientific research and innovative technologies to ensure science responds to the needs of society focused around seven outcomes (Ryabinin et al., 2019):

- A clean ocean, where sources of pollution are identified and removed.
- A healthy and resilient ocean, where marine ecosystems are mapped and protected.
- A predictable ocean, where society has the capacity to understand current and future ocean conditions.
- A safe ocean, where people are protected from ocean hazards.
- A sustainably harvested ocean that ensures the provision of food supply.
- A transparent ocean, with open access to data, information, and technologies.
- An inspiring and engaging ocean, where society understands and values the ocean.

Core natural and social science needed to help inform policymakers on successfully integrating initiatives that address both the consequences of climate change and biodiversity loss can be defined and implemented as part of the UN Ocean Decade. Far greater efforts and support are required to understand ocean ecosystems and climate impacts in poorly understood realms such as the open ocean, midwater column, and deep sea floor, as well as coastal habitats and communities.

The UN Ocean Decade is a tremendous opportunity to advance the knowledge and management needed for a healthy, productive, and resilient ocean, yet far greater governmental and private investment and support are crucial if it is to achieve its outcomes for the benefit of all. Now is the time to engage in and support the UN Ocean Decade if we are to meet the constantly evolving needs of ocean and coastal zone communities, decision makers, and managers in the face of rapid change and accelerating pressures, now and into the future.

As the world builds forward better with a greater interest than ever before in nature's recovery, better mechanisms are needed to track and understand progress (Adams et al., 2021). Educationally we need to support and boost public understanding of the value of the natural world and its links to human well-being (Kelly et al., 2021). A more inclusive, equitable, and transparent narrative is required to explain why and how the ocean is important to life on earth (Bennett, 2018), and this should be grounded in the needs and perspectives of local communities and indigenous peoples who depend on the ocean (Bennett et al., 2021). Indigenous peoples and local communities act as managers in many diversity hotspots (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2019) and possess knowledge that recognizes the value of the ocean (Eckert et al., 2018). As many are reliant on the same ocean that has traditionally been designated for protection, a 'shared ocean approach' could provide a legitimate framework for locally relative but globally applicable action (Obura et al., 2021).

3 | CONCLUSION

Vast changes are needed to improve how success is measured and reported, who participates in this assessment (Woodcock et al., 2016), and at what spatial scale. This will make it easier to see and celebrate successes, to identify where more action or support is needed, and to effectively develop the initiatives that are most appropriate for a specific context. Sadly, in 2021 there is still much to be done to implement a single transparent system to track conservation (protective and management practices) and stress-inducing activities (resources extraction) in the global ocean. If we are serious about navigating towards a sustainable ocean, then more expansive education opportunities, inclusive narrative and equitable decision making, and improved reporting systems on how we are acting to protect our natural world are desperately needed.

By committing to targets of protection and restoration, and the resources to meet these targets globally, nations at COP26 can start to develop the immediate action required to reverse the decline in ocean services that has resulted from the consequences of climate change and actions that have caused biodiversity loss. COP26 is well placed to support this as the United Nations Framework Convention on Climate Change (UNFCCC) has 197 parties, more than the UN Convention on Law of the Sea, with 168 parties, or most other international instruments. The challenge of climate change is a whole world challenge, affecting all services provided by the ocean: from temperature regulation and food provisioning to the provision of water and carbon cycles, and national security. Everyone, including those from landlocked countries, has a vested interest in the health of the ocean and its ability to continue to provide the services that make this planet habitable.

Under the auspices of the Paris Agreement, states can build holistic climate- and biodiversity-friendly ocean protections into their Nationally Determined Contributions, National Adaptation Plans, the Article 6 rulebook, and into accelerated climate ambition. The global stocktake can include metrics that link the health of the ocean to the health of the planet. The UNFCCC Ocean and Climate Change Dialogue, endorsed at COP25 and initiated in 2020, identified the need for transdisciplinary international dialogue on the ocean and climate change in the realms of collaborative science, finance, and policy (Dobush et al., 2021; Subsidiary Body for Scientific and Technological Advice (SBSTA), 2021). The Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ) Treaty, with sufficient leadership and ambition during these final stages of its negotiation, can provide the framework for ensuring complimentary action in ABNJ to build ocean and institutional resilience (Yadav & Gjerde, 2020). To maintain momentum, the COP26 negotiators should endorse and sustain a continuing Ocean Dialogue and adopt an Ocean Agenda item to prioritize ocean action. Underpinning all of this must be the stepping up of inclusive, collaborative, and equitable research and monitoring in ocean science for the future that addresses the climate and biodiversity challenges together.

There is already sufficient evidence to know that we must act now, and experience shows initiatives will need to take the form of a suite of actions with long-term obligations. By addressing these issues in a moral, equitable, and multidisciplinary manner, the people in regions disproportionately enduring the greatest impacts from climate change and biodiversity loss (e.g. tropical countries) (Sumaila, Tai, et al., 2019) can be supported by those who are yet to experience the same, who all have 'common but different responsibilities' (UNFCCC). The UN Decade of Ocean Science for Sustainable Development provides a framework for actions, targets, and metrics to measure success, and although potential threats (e.g. deep-sea mining) are yet to be realized, there is a good opportunity to engage with action to support the ocean and the benefits derived by humans from it. As the ocean is vital to all life on earth, COP26 is the opportunity to commit to actions that will provide a promise of a healthy planet for both current and future generations.

CONFLICT OF INTEREST

All authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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