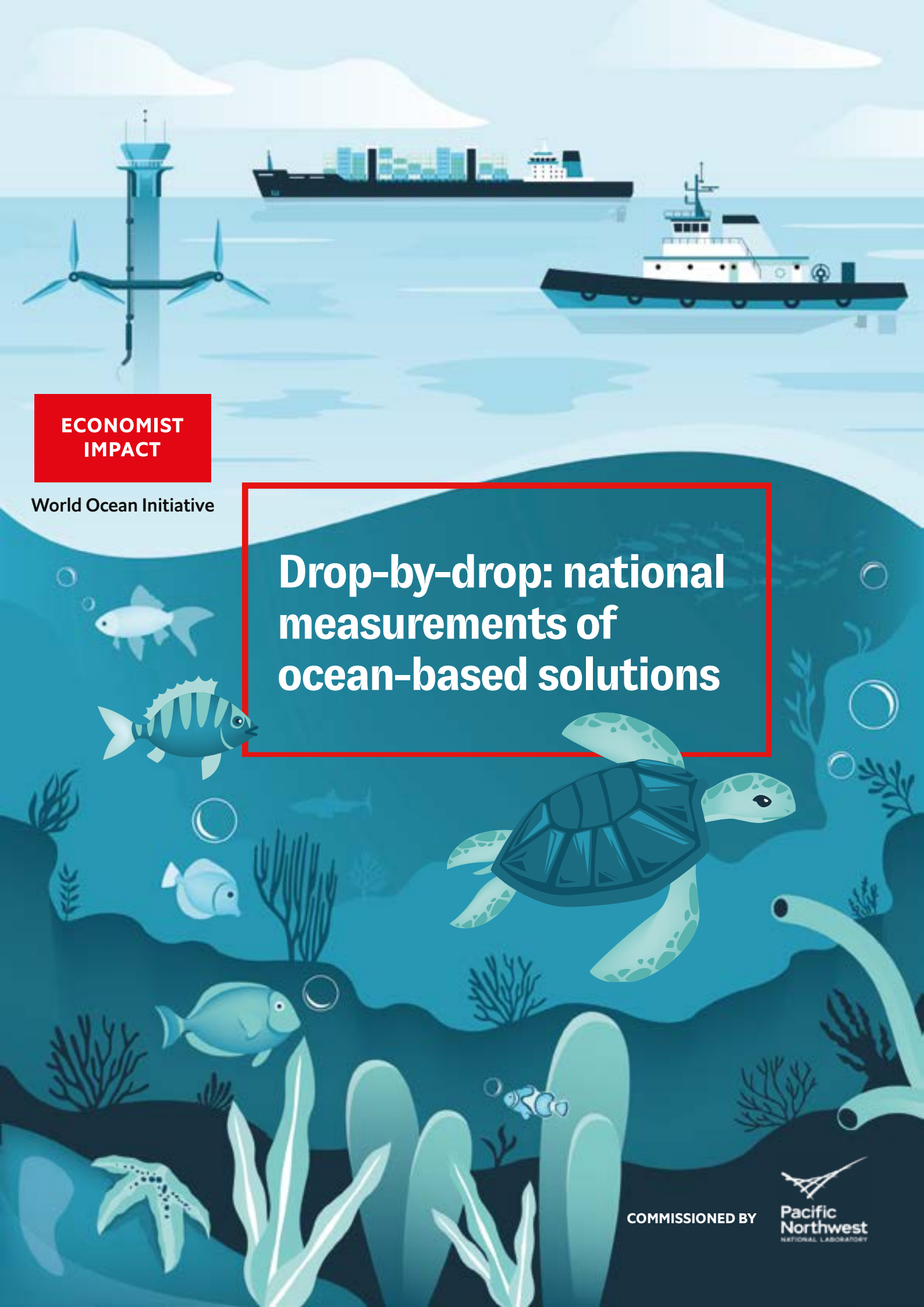

ECONOMIST IMPACT

World Ocean Initiative

Drop-by-drop: national measurements of ocean-based solutions

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Contents

About the research and acknowledgements

Drop-by-drop: national measurements of ocean-based solutions is an article from Economist Impact's World Ocean Initiative, commissioned by Pacific Northwest National Laboratory (a US Department of Energy National Laboratory). This is the second in a three-article series on ocean-centred climate change mitigation and adaptation. The first article can be found here.

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- **Ben Milligan,** secretariat director, the Global Ocean Accounts Partnership (GOAP) at the University of New South Wales
- **John Virdin,** director of the Ocean Policy Program, Duke University's Nicholas Institute for Environmental Policy Solutions

The High Level Panel for a Sustainable Ocean Economy estimates that ocean-based climate solutions offer as much as 21% of the emissions reductions needed to achieve a pathway that limits global warming to 1.5° by 2050. They also could immensely contribute to climate change adaptation efforts. These options span a range of sectors, including solutions such as ocean-derived energy, marine transport decarbonisation, more ocean-centric food systems and carbon-dioxide removal. However, our understanding of when and where these solutions can provide the greatest benefit—and how to incentivise further investment—is limited by an inability to reliably assess country- and project-level impacts.

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Effective measurement of a set of interlinked factors, including decarbonisation, energy needs, economic and social impacts, is required to give national-level policy- and decision-makers the information they need to make fully-informed choices on the relative benefits and tradeoffs of particular climate change solutions. Moreover, that which can't be measured, can't be traded. Governments' ability to assess ocean solutions's carbon benefits against their costs and potential impacts will become especially important for integration into global carbon markets as these schemes mature, and will thus be important for putting ocean solutions on equal footing with those on land.[1]

[1] Carbon pricing designates a dollar amount by which countries can quantify the value of the carbon mitigation potential of ocean based solutions. Countries' carbon taxes vary, and some apply Emissions Trading Schemes, which are incorporating initial applications for ocean-based solutions. See: "Carbon Pricing Dashboard." The World Bank. https://carbonpricingdashboard.worldbank.org/ and "Putting a Price on Carbon with an ETS." The World Bank. background-note_ets.pdf (worldbank.org)

Current efforts are progressing, but more work is needed

Countries typically report some macroeconomic and emissions outcomes, but further development is needed to build accounting that can accurately quantify marine-based climate mitigation and adaptation activities, and the resulting societal impacts. As Prof Ken Findlay, research chair of oceans economy at the Cape Peninsula University of Technology, puts it, "it's absolutely critical that we develop some kind of framework that can facilitate the input of transdisciplinary data to derive valuation systems from these data, and this is where ocean accounts come in." Ocean accounting frameworks—in which the marine environment and the activities that occur within it are measured as part of broader national accounts systems—are evolving to meet the needs of a variety of nation-specific contexts, and measurements beyond simply economic metrics.

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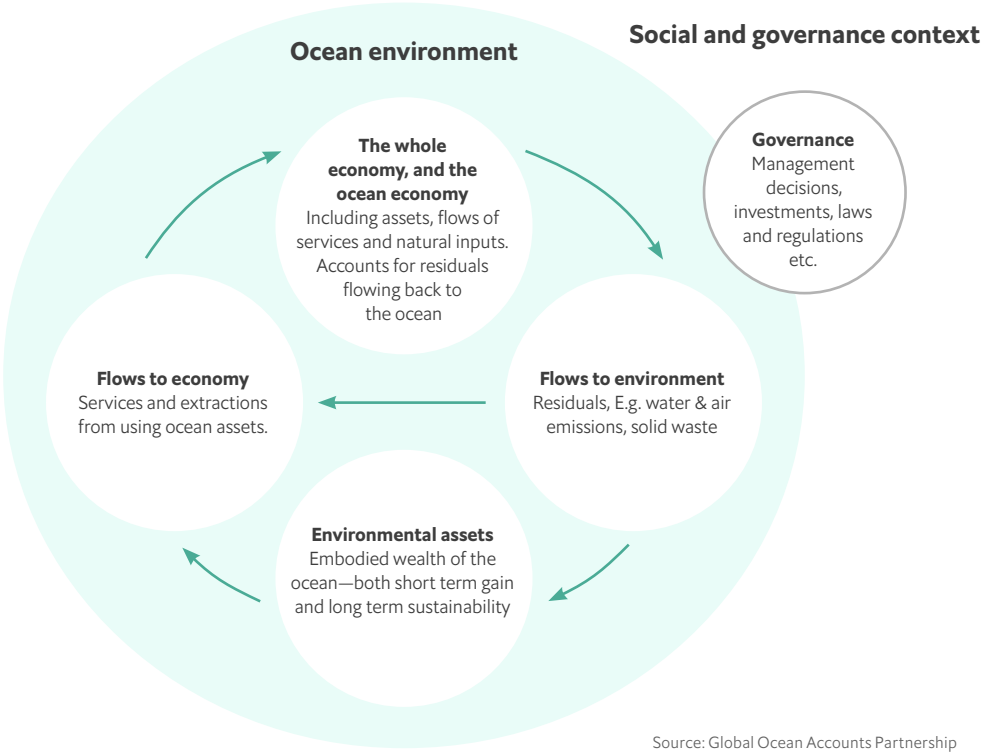
Robust, internationally validated frameworks to integrate ocean activities and environmental value into existing national accounting systems have been developed, but these have yet to see widespread adoption. These frameworks improve on national-level measurement systems by integrating the value of ocean activities into national planning, as well as monitoring progress towards the Sustainable Development Goals. These efforts are essential. As Dr John Virdin, director of the ocean and coastal policy program at Duke University's Nicholas Institute for Environmental Policy Solutions, notes, "accounting for the benefits from ocean-based industries and ocean resources allows policymakers to at least make cost-benefit analyses." He stresses that these programmes must be holistic, adding "we also need to factor in environmental degradation, unsustainable use of resources, and social measures, which may not lend themselves as well to easy accounting, for a more informed understanding of the trade-offs."

One framework leads the way

The Ocean Accounts Framework is the most comprehensive effort to date for capturing the full national-level economic, environmental and societal value of ocean activities.[2] It takes stock of and puts into economic terms the natural value of the ocean; marine goods and services; impacts on and from the ocean environment; and a variety of governance and social metrics including the contributions of the ocean to people's wellbeing (such as employment and sense of place), protection and management, policies and laws, risk and resilience, and technologies (see Figure 1). The measurement, aggregation and reporting standards set by the Ocean Accounts Framework are designed to support critical policymaking around the ocean for long-term sustainability by harmonising and integrating information.

The framework was developed by a co-ordinating body, the Global Ocean Accounts Partnership (GOAP), which was founded by UN-ESCAP, and is supported by the World Bank Blue Economy Program and the UK government's Blue Planet Fund. Ben Milligan, the secretariat director of the GOAP at the University of New South Wales, summarises the multifaceted nature of the partnership, characterising it as "a collaboration of interested governments, research institutions and others who are working together to implement accounting systems and learn from each other." He notes that the partnership provides guidance, applies research and coordinates advisory, capacity-building and financial support for ocean accounting in interested countries.

Figure 1: Key components of the Ocean Accounts Framework



Source: Global Ocean Accounts Partnership

[2] The Ocean Accounts Framework is compatible with existing UN-developed international statistical standards, such as the System of National Accounts, which is the global standard for national accounting, and the System for Environmental-Economic Accounting (SEEA). The Ocean Accounts Framework also complements ocean-specific policy goals outlined in the 23rd Conference of the Parties to the UN Convention on Climate Change (COP 23) Ocean Pathway.

Global partnerships of this type are essential for sharing best practices, building capacity for ocean accounting, and facilitating the development of digital reporting tools and platforms to make this information available. Data are often scattered across varying government entities or, in some cases, not available. According to GOAP, international standards also help to prevent individual countries from measuring in different ways or using different assumptions, all of which hamper comparability and global alignment.

First steps for oceans

Many countries are now formally assessing the national contributions of their natural endowments and the activities that take place engaging with these spaces. Mr Milligan comments that "more than 80 countries around the world now implement varying degrees of a national measurement system in a terrestrial context", although he reiterates that "ocean systems are still very far behind." A number of countries—including Australia, Canada, China, Malaysia, Samoa, Thailand and Vietnam, among others—have participated in pilot studies of the Ocean Accounts Framework to assess the viability of its components. Other countries are working to actively develop ocean accounts, while some have ocean assessment activities that provide the foundation for such accounts. Many of these efforts are still in early stages.

Take Vietnam, for example, which aims to use ocean accounting to understand and promote a number of outcomes in the Quang Ninh province, including sustainable tourism, restoring the protective function of coastal forests, natural disaster mitigation, carbon dioxide absorption, biodiversity conservation, emissions reductions, and socio-economic development. A pilot of the Ocean Accounts Framework has been used to balance the economic value of fishing, shipping and tourism in the region with the need to sustain healthy mangrove, coral reef and seagrass ecosystems. Although accounting measures are not yet in place on a national level, the early stages of this pilot programme focus on assessing sea-based pollution and tourism impacts, and these early efforts demonstrate the long-term value of accounting for ocean-based climate solutions to advance efforts to achieve broader policy goals.

Canada's pilot programme pioneers efforts to collect, integrate and analyse fragmented scientific, economic and commercial fishing data while establishing new socio-economic data collection to meet policy commitments in support of healthy oceans and more resilient coastal communities. Though it has encountered challenges with data collection and cross-sectoral co-ordination, Canada seeks to use the pilot to enhance technical capacity, raise awareness of the benefits of ocean accounting and develop a broader consensus on ocean accounting parameters.

Beyond the official pilots, other countries have also implemented pieces of the Ocean Accounts system, largely related to assessing marine goods and services. The US, for example, has begun reporting how the ocean contributes to its economy through the US Ocean Satellite Account. This captures activities relating to fishing, ocean transport (including related services, such as building vessels), and electric power generation, although data about some areas—for instance offshore wind and other ocean energy sources such as tidal power—are not yet disaggregated. The satellite account findings (including outputs and value-added) are calculated using the same procedures as other satellite accounts (for instance, travel and tourism) to enable comparison.

Norway has long been considered a leader in ocean industries and accounting. It already captures economic data related to a number of specific ocean-based climate solutions, providing a dashboard that aggregates this information and enables leaders to quickly familiarise themselves with relevant economic information. Accessible ocean knowledge has (among other factors) contributed to Norway becoming a leader in ocean-based climate solutions. Joshua Berger, the founder and president/CEO of Maritime Blue, a US-based cluster organisation focused on the sustainable and equitable blue economy, notes that Norway's innovation cluster programme has successfully enabled public private partnerships. These activities rely in part on sound economic and accounting data to prove the value of ocean investments.

Despite this progress, most countries still lack harmonised accounting for non-produced ocean assets. This includes a lack of accounting procedures that adequately capture and balance social and governance issues relating to the ocean. The global entrenchment and primacy of economic measures such as GDP and GNI creates headwinds for proponents of more-inclusive national accounting, including of the marine environment. Nicole LeBoeuf, assistant administrator for the US National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service, comments that, "we need to do a better job of assessing non-market and market value of coastal ecosystems. Similarly, we need better data about carbon sequestration and natural and nature-based protective value, and we are still learning more about these important non-market contributions."

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The question of carbon

The Ocean Accounts Framework also includes measures of carbon sequestration and considers carbon emission flows to the environment, which are important for understanding the mitigation potential of the various ocean based solutions. Most countries currently measure greenhouse gas (GHG) emissions and carbon sinks to assess progress towards nationally determined contributions (NDCs) as part of the 2015 Paris Agreement. These measurements are used to assess the efficacy of climate solutions, including ocean-based ones, to answer policy questions and help direct investments towards projects. However, existing GHG emissions frameworks and measurement tools have notable data gaps when it comes to capturing ocean and ocean-based activities in mitigation and adaptation, rendering these tools less effective.

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For example, although the Intergovernmental Panel on Climate Change, which maintains standards for national GHG inventories, includes coastal wetlands in accounting as of 2013, major gaps remain in both measuring and standardising accounting of blue carbon estuarine systems (beyond just wetlands) as well as coastal systems and shelf seas. The High Level Panel for a Sustainable Ocean Economy urges the adoption and enhancement of carbon accounting methodologies to better capture blue carbon in national GHG inventories. The transboundary nature of much of the ocean further complicates the prospect of wholescale measurement of the contributions of ocean solutions. This is especially true of marine carbon dioxide removal, including maintaining and restoring marine ecosystems.

There is room for improved measurements in specific sectors as well. When it comes to transport, for example, decarbonising shipping is justifiably a major focus, but information on decarbonisation of other forms of marine transport (such as for fishing fleets, recreational boats and ferries) tends to be more scarce. However, enhanced emissions measurements in this area would help enable successful vessel decarbonisation policy. Vietnam provides an early example of a country using data to achieve this end, mandating that all ship owners, not only commercial carriers (such as cargo

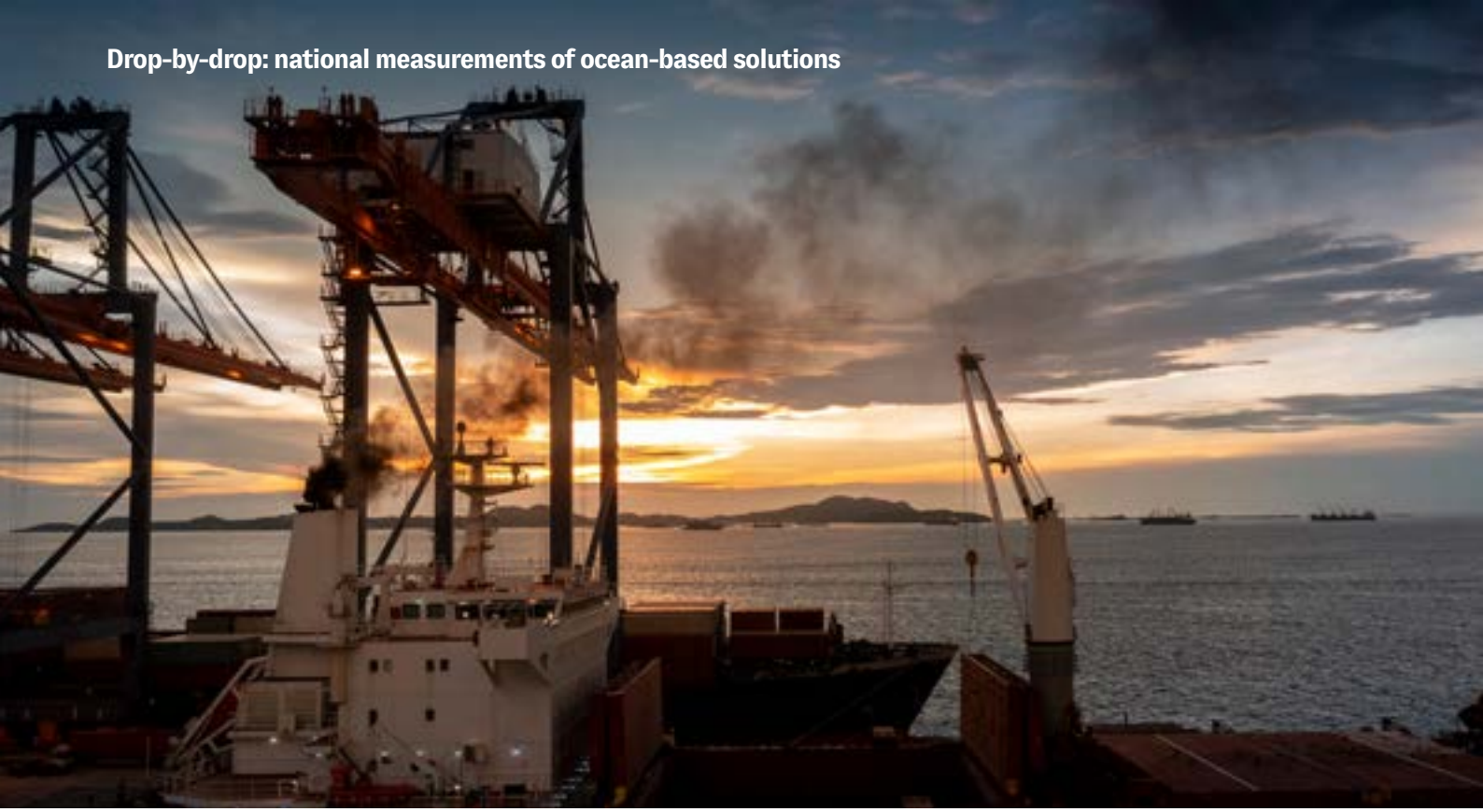
ships and tankers), report fuel consumption data to support emissions reductions, marine environment protection and air quality targets.

The US offers a clear case of carbon emissions data gaps leading to challenges for assessing emissions from specific sectors. In the US, these gaps also complicate the process of measuring emissions captured by natural resources. While the US's most recent inventory of GHG emissions and carbon sinks does include a variety of activities and resources, including coastal aquaculture, maritime transport, offshore energy extraction and coastal wetlands, it explicitly mentions the insufficiency of current estimates of waterborne fuel consumption, and the lack of sufficient data to measure the GHG impact of seagrasses.

Efforts to rectify data limitations will likely be under way as part of the GHG emissions tracking requirements of the Global Stocktake, which is a process set out by the Paris Agreement to facilitate the assessment of climate commitments and actions, including information specifically on ocean-climate actions. The Global Stocktake captures information such as GHG emissions by sources and removals by carbon sinks, mitigation efforts of countries, fairness and equity considerations, and provides a baseline for global best practices. The first Global Stocktake will take place in 2023 and signals growing momentum towards more countries explicitly measuring ocean-mitigation efforts. However, it relies in part on national accounting, so quality reporting by countries is essential to ensure the accuracy of its collective inputs.[3]

Another tool that relies on accurately assessing carbon flows, including in the marine environment, is the social cost of carbon (SCC). The SCC is used to estimate in monetary terms all damages that would result from one ton of carbon dioxide emitted into the atmosphere. It includes discounting for avoided damages in the future, and helps account for the societal benefits when considering the merit of ocean-based solutions (and all decarbonisation efforts) versus

[3] The Global Stocktake will include GHG emissions inputs such as national GHG inventories; National Inventory Reporting on agriculture, land use, land-use change, forestry, transport, shipping, energy and energy efficiency; Intergovernmental Panel on Climate Change (IPCC) reporting; International Maritime Organization indicators and World Ocean Assessment data. See: https://www.iucn.org/sites/dev/files/content/documents/2021/the_ocean_and_the_unfccc_gst.pdf



the status quo. In the ocean accounting system, the social cost of carbon is used as a proxy for measuring the value of carbon sequestration if no current traded value of carbon exists.

However, the SCC is not yet considered a fully comprehensive measurement of societal impact, and debates over the use of the SCC as a tool for policymaking are ongoing. A recent court ruling in the US has prohibited the use of the SCC for making US policy, which will alter impact analyses relating to infrastructure and climate change initiatives, including those that are ocean-based. Broader global discussions over how to determine the SCC are also under way. Dr Charles Colgan, director of research for the Center for the Blue Economy at the Middlebury Institute of International Studies, notes "there are a lot of arguments about how the SCC ought to be calculated. The calculation depends on the choice of discount rate, and estimations about how much carbon is going to be emitted into the atmosphere. There are some important arguments about whether the value of human life should be included in the calculation." Agreement on the calculation of the SCC would further its usage and support measurement of the social impact of ocean-based solutions.

Agreement on the calculation of the social cost of carbon is essential to further its usage generally, and for better measuring the social impact of ocean-based solutions.

Getting micro(ish): project and local ecosystem assessments

As countries continue to invest (whether directly or indirectly) in climate change solutions, it will be incumbent on them to develop methods not only for incorporating marine activities into national accounting, but also for assessing individual projects, or providing the building blocks for such assessment to other stakeholders. Accurate and consistent measurement methods allow countries to better assess ocean-based projects and help guide plans to capitalise on marine opportunities. For instance, despite their promise, much remains unknown about the real-world impacts—both positive and negative—from emerging marine carbon dioxide removal technologies, such as ocean alkalinity enhancement and artificial upwelling.[4] However, even if the general science becomes more clearly understood, governments will need to be able to make project- and site-level assessments, or have a clear enough understanding of these assessments to provide practical policy guidance for what could be a risky set of technologies.

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This type of specific, targeted, project-level guidance or policymaking will require an even more granular level of data gathering, aggregation and distribution on the part of governments (whether national or sub-national). Emergent versions of such tools already exist. As Ms LeBoeuf explains, NOAA already provides a Digital Coast platform, which includes data, tools, training and stories/case studies on everything from managing risk to conducting economic analysis and was recently updated with the most recent sea level rise projections available. The platform is designed for communities, municipalities and other stakeholders and helps provide a level playing field of information.

[4] Ocean alkalinity enhancement involves spreading large amounts of materials (such as carbonate materials) to enhance the chemical weathering reactions that absorb atmospheric CO2. Artificial upwelling is when nutrient-rich deep water fertilizes the ocean surface to enhance, phytoplankton growth, raising the ratio of carbon to inorganic nutrient utilization to increase the potential for CO2 removal. See: https://www.geomar.de/en/research/fb2/fb2-bi/research-topics/tipping-points-2 . See: Keller, David, Lenton Andrew, Littleton, Emaa et al. "The Effects of Carbon Dioxide Removal on the Carbon Cycle." Current Climate Change Reports. P. 250-265. 2018. https://link.springer.com/article/10.1007/s40641-018-0104-3

What comes next?

Beyond the question of measurement sits the thorny issue of prioritisation. This will need to involve more than assessing cash flows, economic multipliers or GHG drawdown. It must also consider existing users of coastal and marine spaces, community impacts, and, ultimately, the messiness of human preferences and biases. As Ms LeBoeuf puts it, "we need to reframe our relationship with the ocean entirely, and we need to focus our efforts on improving our near-term predictive capabilities for decisions affecting economic objectives and risk management. She adds, "Looking further out, we must also understand that the world is changing in profound ways, and employ authoritative scientific information to increase our confidence in longer-range projections and thus our plans affecting economies and societies."

Undertaking ocean accounting efforts at a more comprehensive level is challenging. Some climate mitigation and adaptation activities, or social and governance factors that should be accounted for are not being measured, while others are not measured or assessed in a way that would allow for precise accounting.

All of these efforts require resources, political intention, buy-in and enhanced data collection, which are often lacking. However, incorporating more ocean information into national accounts is vital for helping countries capitalise on ocean-centred opportunities for meaningful climate action while maximising outcomes for all stakeholders, spanning existing ocean users, coastal communities and even all citizens. Mr Berger believes that the early efforts to assess the impacts of ocean climate solutions are already helping to determine the return on investments in ocean-based solutions, remarking that "we have come a very long way just in the last few years in highlighting and defining the ocean economy in and of itself, and finding where the growth opportunities are in what we call the sustainable and equitable blue economy."

Ultimately, measurement is critical, but only part of the battle. The next step is using these measurements to understand who 'wins' and who 'loses' from these solutions, and implementing policy accordingly to maximise benefits, minimise harm and create equity while moving towards a net-zero future.

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