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HIGH LEVEL PANEL for  
**A SUSTAINABLE  
OCEAN ECONOMY**

# A Sustainable and Equitable Blue Recovery to the COVID-19 Crisis

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## About this Paper

The High Level Panel for a Sustainable Ocean Economy (Ocean Panel) is a unique initiative by 14 world leaders who are building momentum for a sustainable ocean economy in which effective protection, sustainable production and equitable prosperity go hand in hand. By enhancing humanity's relationship with the ocean, bridging ocean health and wealth, working with diverse stakeholders and harnessing the latest knowledge, the Ocean Panel aims to facilitate a better, more resilient future for people and the planet.

Established in September 2018, the Ocean Panel has been working with government, business, financial institutions, the science community and civil society to catalyse and scale bold, pragmatic solutions across policy, governance, technology and finance to ultimately develop an action agenda for transitioning to a sustainable ocean economy. Co-chaired by Norway and Palau, the Ocean Panel is the only ocean policy body made up of serving world leaders with the authority needed to trigger, amplify and accelerate action worldwide for ocean priorities. The Ocean Panel comprises members from Australia, Canada, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Palau and Portugal and is supported by the UN Secretary-General's Special Envoy for the Ocean.

The Ocean Panel's approach is both ambitious and practical. Collaborative partnerships are essential to converting knowledge into action. To develop a common understanding of what a sustainable ocean economy looks like, the Ocean Panel gathers input from a wide array of stakeholders, including an Expert Group and an Advisory Network. The Secretariat, based at World Resources Institute, assists with analytical work, communications and stakeholder engagement.

In the spirit of achieving the UN Sustainable Development Goals (SDGs), providing value to the UN Decade of Ocean Science for Sustainable Development and meeting the objectives of the Paris Agreement, the Ocean Panel commissioned a comprehensive assessment of ocean science and knowledge that has significant policy relevance. This includes a series of 16 Blue Papers and various Special Reports that offer a synthesis of knowledge, new thinking and perspectives, and opportunities for action. This body of work is informing a new ocean narrative in the forthcoming Towards a Sustainable Ocean Economy report. Together, this research and new narrative serve as inputs to the Ocean Panel's deliberations for its forthcoming action agenda.

The Ocean Panel commissioned the Secretariat at World Resources Institute to prepare this Special Report, which examines the impacts of the COVID-19 pandemic on the ocean economy and the role of ocean-based solutions in supporting sustainable and equitable recovery to the crisis. This paper is an independent input to the Ocean Panel process and does not necessarily represent the thinking of the Ocean Panel.

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# Foreword

Over a third of the world's population lives within 100 kilometres of the ocean. Despite this, the role the ocean plays in sustaining human life and the global economy is often underappreciated and overlooked. The ocean not only provides us with oxygen, food and energy, it fuels the global economy, enabling the exchange of goods and services across vast distances. The health of the ocean, and its ability to continue providing vital services, underpins the global economy but also much of human life.

The COVID-19 pandemic has had severe ramifications worldwide, and the ocean economy is no exception. While initially projected to double by 2030, the growth of the ocean economy has been hindered by COVID-19, with significant revenue losses throughout. Port closures, travel restrictions and supply chain disruptions have disrupted ocean-based industries such as shipping, marine and coastal tourism and fisheries. As with many crises, it is the most vulnerable groups, such as coastal communities and informal workers, that are hardest hit.

The ocean economy may be a victim of the impacts of the COVID-19 crisis, but it also holds solutions for rebuilding a more resilient, sustainable and equitable post-COVID world. Investment in 'blue' recovery and stimulus packages, along with policy reform, can immediately create jobs and provide short-term economic relief, all while fostering long-term economic growth, resiliency and social and environmental benefits. As we look to rebuild, cooperation between government and the public and private sector as well as a departure from 'business as usual' can ensure this transformation.

The High Level Panel for a Sustainable Ocean Economy (Ocean Panel) commissioned the Secretariat at World Resources Institute to develop an assessment identifying the impacts of COVID-19 on the ocean economy and to provide interventions which will catalyse a sustainable recovery and enhance resilience. This report provides a timely snapshot of the interconnected nature of the impacts currently being experienced across the ocean economy by those who rely on it for their livelihoods and food security. It provides practical guidance and identifies five ready-made solutions which will deliver jobs and significant economic benefits: (1) invest in coastal and marine ecosystem restoration and protection, (2) invest in sewerage and wastewater infrastructure for coastal communities, (3) invest in sustainable community-led non-fed mariculture, (4) incentivise zero-emission marine transport and (5) incentivise sustainable ocean-based renewable energy. To date, many stimulus packages have overlooked the role the ocean can play in a 'blue' recovery. This report clearly demonstrates why policymakers should look to the ocean economy for mutually beneficial, no-regrets investments that will help the world set a course to a more resilient, sustainable and equitable future.

As co-chairs of the Ocean Panel Expert Group, we wish to warmly thank the Secretariat and reviewers for responding rapidly and effectively to the opportunity to conduct this novel assessment. We also thank the members of the Ocean Panel for their support of this report. We hope they and relevant parties are able to act on the paper's findings and accelerate recovery in a post-COVID-19 world through 'blue' investments.



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## Highlights

- With a longer-term vision and the right actions, the COVID-19 pandemic can mark the beginning of a new type of global and societal cooperation in building a sustainable ocean economy.
- The pandemic has had deep and wide-reaching consequences for people around the world, resulting in a crisis that has led to significant loss of human life, increasing food and nutritional insecurity and poverty, and affecting almost all areas of the global economy.
- The ocean economy, which contributes upwards of US\$1.5 trillion in value added to the global economy has been particularly hard hit by the pandemic. Significant revenue losses have been felt across coastal and marine tourism, fisheries and aquaculture, and the global shipping industries. Hundreds of millions of jobs have been affected, with disproportionate impacts for developing and small island nations and already vulnerable coastal communities.
- The linkages between ocean-based sectors and land-based economies mean that the pandemic's impacts flow beyond these individual sectors, with economic and social repercussions across the entire economy. A sustainable and equitable recovery is critical not just for those who live or work near the coasts but for the well-being and resilience of societies and economies at large. Despite the significance of the impacts, only a limited number of investments through stimulus and recovery packages are currently directed towards affected ocean workers, coastal communities and the sustainable rebuilding of the ocean economy.
- Furthermore, many response measures have the potential to reverse progress made to date on ocean sustainability and exacerbate the existing threats to ocean health, undermining the myriad non-monetary benefits provided by the ocean which are essential to human well-being and prosperous societies, and the ability of the ocean to continue to be a workplace, a source of income, livelihoods and nutritional food for billions of people worldwide.
- Investment through recovery and stimulus packages represents a crucial lever for accelerating the shift from business as usual to a more sustainable future that delivers on global targets under the 2030 Agenda for Sustainable Development, the Convention on Biological Diversity and the Paris Agreement.
- Humanity is at a critical crossroads. Stimulus which locks in high-emitting, high-polluting and inequitable development pathways now will have catastrophic implications for ocean health, the global climate emergency, economic resilience, human health and prosperity.
- The strategic investment of recovery and stimulus funds into the ocean economy offers an untapped opportunity to support job creation and economic diversification and relief in the short term. Such investments can also accelerate the sustainable and equitable growth of ocean industries, thereby securing the long-term health and resilience of the ocean and ocean economy and the myriad benefits that it provides to humanity.
- This report proposes a set of five priority opportunities for governments to consider for the immediate investment of stimulus funds to support a 'sustainable and equitable blue recovery' from the COVID-19 crisis. These mutually beneficial, no-regrets 'blue stimulus' opportunities, identified on the basis of criteria, are particularly relevant at this time for their potential to deliver short-term economic, social (health) and environmental benefits for affected communities and sectors, while building longer-term social, economic and ecological resilience:
  - Invest in coastal and marine ecosystem restoration and protection.
  - Invest in sewerage and wastewater infrastructure for coastal communities.
  - Invest in sustainable community-led non-fed marine aquaculture (mariculture) (e.g. shellfish and seaweed).
  - Incentivise zero-emission marine transport.
  - Incentivise sustainable ocean-based renewable energy.



- As evidenced by the stimulus response to the 2008–9 global financial crisis, not all investments will be directed at measures capable of providing job creation in the short term. Instead, much of the investment will be used to lay the foundation for long-term recovery through systemic transitions to improve the efficiency and cost-effectiveness of the economy and initiating large infrastructure projects that will yield benefits over the next 10 to 30 years. This report proposes a set of additional opportunities that are more systemic and oriented towards using this critical juncture to sustainably reset the ocean economy. This will enable the accelerated transition of ocean industries towards smarter, sustainable practices that conserve marine ecosystems, promote human well-being and build social and economic resilience to future shocks.
- Maximising the use of financial mechanisms (e.g. debt restructure and financial grants) offers an unprecedented opportunity to incentivise sustainable recovery efforts and avoid a roll-back in advances already made in sustainable fisheries management, marine conservation and ocean data.
- Heightened awareness of the importance of coordinated and evidence-based global action to shared challenges, and rapid shifts towards new technologies and working practices as evidenced during the COVID-19 crisis, may create new opportunities for advancing the 2030 Agenda for Sustainable Development and the Paris Agreement.
- The urgency cannot be overstated. As the world continues to battle the health crisis, millions are without incomes to provide for themselves and their families. They need a job and a lifeline, for right now and for the future. Policymakers and financial decision-makers must consider the potential of the ocean economy’s role in social and economic recovery and ensure that the ocean economy rebuilds to be more sustainable, equitable and resilient—as this is key to our global prosperity and well-being.











# 1. Introduction

A healthy ocean is the foundation for prosperous, healthy and vibrant economies. There is an unprecedented opportunity, through global stimulus and recovery responses to the COVID-19 crisis, to reset and rebuild economic activities in ways that will ensure a more sustainable, equitable and resilient ocean economy fit for everyone's future. This report provides a roadmap to achieve this vision.

## 1.1 Context

The COVID-19 pandemic has caused an unprecedented human health crisis around the world, resulting in significant loss of life. Emergency measures introduced to curb the extent of the virus have led to severe restrictions on human mobility, economic activities and services, affecting large swathes of the economy and resulting in widespread unemployment and impacts on people's livelihoods, well-being and wider health (Xu and Joyce 2020).

The resulting global economic downturn is expected to exceed the one experienced during the 2008–9 global financial crisis (Bluedorn and Chen 2020). The global economy is projected to contract by 4.9–6 percent in 2020 (IMF 2020a), the largest economic dip since the global depression of the 1930s (OECD 2020c). Gross domestic product (GDP) is expected to shrink in nearly every country in 2020, although with significant variation reflecting differing national circumstances.

As economic projections have been revised downwards, unemployment has continued to rise. Worldwide, some 300 million full-time jobs could be lost, and nearly 450 million companies are facing the risk of serious disruption (ILO 2020c), reducing local

incomes, tax revenues and foreign exchange earnings. Early evidence suggests that groups that were economically most vulnerable before the pandemic will experience the greatest impacts, exacerbating existing inequalities within society (UN DESA 2020a). Globally, the COVID-19 pandemic may force as many as 100 million people into extreme poverty and could double the number of people facing acute hunger, to 265 million people by the end of 2020 (Anthem 2020).

The ocean connects cities and countries around the world, driving economic activity and trade for the more than a third of the global population

Before the pandemic, ocean-based industries such as fishing, energy, shipping and marine and coastal tourism had been conservatively estimated to contribute 2.5 percent of world gross value added, a value that was predicted to double by 2030 (OECD 2016).

As of 2010, these ocean-based industries contributed some 31 million direct full-time jobs (OECD 2016). This figure is significantly higher when jobs provided through informal or artisanal employment are included. For example, upper estimates in 2011 suggest that the fisheries sector alone provides the equivalent of 237 million full-time jobs when small-scale fisheries and artisanal employment are also considered (Teh and Sumaila 2013). The ocean also connects cities and countries around the world, driving economic activity and trade for the more than a third of the global population that lives within 100 kilometres (km) of the sea (Kummu et al. 2016). Most of the world's megacities are located in the coastal zone.

A healthy ocean not only underpins the global economy but also provides myriad non-monetary benefits alongside essential goods and services that are vital for healthy human societies, including regulating the global climate, offering a storehouse of compounds key for fighting disease (Blasiak et al. 2020) and providing natural infrastructure to protect against storm surges, flooding and coastal erosion. Fish and fish products are among the most highly traded foods in the world, supplying a critical source of animal protein, micronutrients and omega-3 fatty acids, particularly in low-income, food-deficit countries and small island developing states (SIDS) (FAO 2020a).

The pandemic has significantly disrupted ocean sectors and global supply chains. These ocean industries do not operate in isolation from one another, or from the ocean environment of which they are part (OECD 2016). This has led to cascading and interrelated impacts across the ocean economy, marine ecosystems and society.

Fiscal measures announced in response to the COVID-19 crisis by G20 nations are already three times greater than those made available during the 2008–9 financial crisis. More is expected as the focus shifts from emergency spending to recovery investments. The UN secretary general, António Guterres, has called for a coordinated approach to social and economic recovery from the

pandemic, a response that does not lose sight of the parallel threat to the global community posed by the climate emergency. Leaders from business and civil society alike are advocating for this unprecedented situation to be used as a catalyst for a cleaner, greener and more resilient future (Harrabin 2020).

The actions that governments and financial institutions take now to repair and rebuild the global economy will chart the course of economic growth and sustainability for many years to come. Although the nature of the investments themselves might have a short-term focus, their impact will be felt over the medium to long term. It is therefore important to avoid locking in high-emitting, high-polluting and inequitable pathways that limit the ability to build sustainable and resilient economic systems. Investment through recovery and stimulus packages represents a crucial lever for accelerating the shift from business as usual to a more sustainable future that delivers on global targets under the 2030 Agenda for Sustainable Development, the Convention on Biological Diversity and the Paris Agreement.

While the solutions will differ from one country to another, humanity has a unique opportunity to reboot economic activities in a way that is more firmly in service of society and restores planetary health for future generations. A healthy ocean is essential in the quest for a sustainable and prosperous future, and it will be an important ally in rebuilding national and global economies from the impacts of COVID-19 and lifting communities out of poverty. Cumulative impacts to ocean health resulting from unsustainable development, overexploitation of natural resources, pollution and climate change are, however, already causing rapid changes across ocean ecosystems, undermining the ocean's ability to continue to provide vital benefits and services to the global economy and humanity. A transformational shift is needed in the relationship between humanity and the ocean, in acknowledgement of its material and non-material values and importance, to ensure that the solutions pursued in response to the COVID-19 crisis do not further undermine ocean health or the future opportunities associated with the growth of a sustainable ocean economy.

The importance of green stimulus to maintain advances towards a greener economy has been recognised by some governments, yet few have recognised the role that 'blue' stimulus opportunities could also provide in supporting advances to meet environmental and climate change challenges. This report considers this gap between the impacts and responses and offers a set of high-level guiding principles for governments and financial institutions to consider as a first step towards ensuing a sustainable blue recovery to COVID-19. It also supports the notion that a 'blue' recovery is a 'green' recovery and vice versa—the decision to ensure a sustainable blue recovery does not come at the expense of a green recovery—they should go hand in hand and cover the full land-to-ocean interface of activities.

Early indications suggest that society may emerge from this crisis to be less cooperative and effective (Sachs et al. 2020). However, with a longer-term vision and the right actions, the pandemic can mark the beginning of a new type of global and societal cooperation in building towards a sustainable ocean economy—which for the purposes of this report is described as the sustainable use of ocean resources (produce) in ways that preserve the health, function and resilience of ocean ecosystems and associated services (protect) and improve livelihoods and jobs (prosper). Given the importance of the ocean as a workplace and a source of income, livelihoods and nutritional food for billions of people worldwide, the importance of resetting the ocean economy on a sustainable and just path so as to reduce vulnerability to future shocks, restore resilience in natural systems and redress existing inequalities must not be overlooked.

## 1.2 About This Report

### Scope

This report aims to provide a holistic assessment of the impact (economic, social and environmental) that COVID-19 has had on the ocean economy. Section 2 considers the emerging impacts on the ocean economy and early responses to the crisis by governments, financial institutions, industry, intergovernmental organisations (IOs) and non-governmental organisations



(NGOs). In considering the impacts, it looks at six key sectors—marine and coastal tourism, fisheries, marine aquaculture (mariculture), shipping, energy and marine conservation—as well as how these impacts are interconnected across the ocean economy as a whole. Recognising that this crisis continues to evolve, these impacts represent a snapshot in time but can still offer important lessons on the scope and degree to which recovery measures must take into account ocean-based sectors, workers and affected communities, and the health of the ecosystems upon which these industries depend.

Section 3 provides a roadmap for a ‘sustainable and equitable blue recovery’ predicated on three mutually reinforcing elements—effective protection of ocean ecosystems, sustainable production and equitable prosperity. It outlines

- high-level guiding principles for ensuring a ‘sustainable and equitable blue recovery’ to aid governments as they consider the nature of their recovery after COVID-19 (Section 3.1);
- ‘blue stimulus’ opportunities that are ripe for the immediate investment of stimulus funding and which can deliver short-term economic benefits to affected communities or sectors while also providing longer-term social and environmental benefits (Section 3.2);
- ‘blue transformations’ opportunities, which through more systemic or longer-term policy reform can accelerate the transition towards a sustainable ocean economy in order to secure economic recovery, resilience and prosperity over the longer term (Section 3.3); and
- ‘blue conditionality’ opportunities associated with financial grants and debt relief which can advance key reforms in areas such as sustainable fisheries management and monitoring and enforcement of protected areas (Section 3.4).

## Approach

The report relies on real-time analysis of impacts of the COVID-19 crisis presented in published reports, working papers and blog posts to help provide an aggregated picture of the resulting economic, social and environmental impacts of COVID-19 on the ocean economy (Section 2.1). The COVID-19 response measures (Section 2.2) are based on systematic review of the policy response reports from international organisations (such as the International Monetary Fund and World Bank), think tanks, consultancies, academic institutions and national government websites. Both the impacts and response measures are rapidly evolving landscapes and, as such, these sections are not intended to provide a comprehensive overview of the status quo.

The opportunities for investment of stimulus funding identified in Section 3 are based on an extensive literature review and set of criteria to identify priorities that respond to the needs of governments and communities now, but which also help catalyse progress towards a sustainable ocean economy. These criteria were selected through literature review, and through expert input from bilateral and multilateral funders and government representatives involved in the design of recovery and stimulus packages. The opportunities highlighted in Section 3 of this report are not exhaustive of what will be required to fully transition to a sustainable ocean economy. There is already extensive literature on the solutions and opportunities for action to build a sustainable ocean economy that should be referred to in conjunction with this report—which focuses on the particular economic challenges and opportunities facing governments at this time. Annex B offers a summary of relevant literature.

The report draws on publicly available information (including news articles, expert opinion pieces, peer reviewed reports, academic studies and project-specific case studies) to identify potential (short- and long-term) economic, social and environmental benefits for the priority areas of action and interventions identified.

The figures included are offered as proof points and illustrative examples, not as conclusive statements or guarantees. For numbers of potential job creation, many of the estimates presented in the report are based on range of studies, including ones that use input-output (I-O) models to derive job numbers, which have their limitations<sup>1</sup>. The benefits (economic, social or environmental) that may accrue as a result of a particular policy decision or financial investment will be specific to the location, economy and population they relate to.

While it is beyond the scope of this particular assessment, the value of new analysis in these areas—particularly an assessment of the direct and indirect

employment opportunities associated with transitioning to a sustainable ocean economy—is well recognised and encouraged to inform decisions that relate to the ocean's contribution to socioeconomic development.

In generating this report, the authors engaged with the 14 offices of the heads of state and government represented on the High Level Panel for a Sustainable Ocean Economy ([www.oceanpanel.org](http://www.oceanpanel.org)) to gather real-time information on country impacts, response measures and priorities, and the relevance and feasibility of interventions for these diverse geographies and economies. This report is, however, an independent input to the Ocean Panel process and does not reflect the views of the Ocean Panel members.

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*1. I-O analyses can portray the linkages between sectors well, based on industry-level accounts. However, they have several weaknesses, including the assumption of fixed prices (prices do not change when demand for a good, service, or input changes), fixed ratios of labour to other factors of production and fixed sectoral share of GDP over time.*







## 2. Emerging Impacts and Early Responses

Jobs and sectors in the ocean economy and already vulnerable coastal communities have been hard hit by the COVID-19 crisis with significant revenue losses felt across coastal and marine tourism, fisheries and aquaculture, and the shipping industry. The linkages between ocean-based sectors and land-based economies mean that these impacts flow beyond these individual sectors to have economic and social repercussions across the entire economy. Only a small proportion of COVID-19 stimulus packages account for the impacts suffered by coastal communities and workers in the ocean economy and an even smaller subset focuses on transitioning to a sustainable ocean economy.

## 2.1 Emerging Impacts on the Ocean Economy

This assessment focuses on the impact that the crisis is having across six ocean-based sectors. We consider three categories of impacts (Table 1):

- **Economic impact** measures the impact on output, jobs, revenue, future investment targets and productivity of ocean-based sectors.
- **Social impact** identifies vulnerable groups (such as women, workers in the informal sector, young workers and Indigenous community members), poorer communities or low-skilled essential workers who face higher health risks due to limited access to healthcare and are disproportionately affected due to job losses and loss of livelihoods.
- **Environmental impact** assesses the benefits and harms to ocean health arising from a range of factors including reduced intensity of ocean-based economic activities, roll-back of environmental policies, changes in societal behaviours (e.g. increased use of e-commerce shipping, disposable personal protective equipment [PPE] and single-use plastics) and reduction in private sector funding for conservation.

### Economic impact

The ocean economy was projected to double by 2030, but this growth potential has been curtailed by COVID-19 (Richens and Koehring 2020; OECD 2016). Significant revenue losses have been experienced across most ocean-based sectors, with coastal and marine tourism

being the hardest hit (UNCTAD 2020b). Across these sectors—in particular coastal tourism, shipping, fisheries and aquaculture—we see a significant loss in revenues, risks of high job losses and reduced appetite for future investment (Table 1).

With a decline in international tourist arrivals, the coastal tourism sector has seen a sharp drop in revenue, putting hundreds of millions of direct tourism jobs at risk<sup>2</sup>. Seafood sectors (both wild fisheries and aquaculture) have been affected by a fall in aggregate demand for seafood due to the closure of restaurants and supply chain disruptions (FAO 2020b; UNCTAD 2020b). Slowed demand has negatively affected maritime shipping, the cruise sector and shipbuilding.

A potential decline in renewable electricity capacity for onshore wind energy and solar farm projects is forecast due to factors such as supply chain disruption, lockdown measures, emerging financing challenges and decreased energy demand (IEA 2020a). The share of renewables in the electricity supply has increased, as their output is largely unaffected by demand<sup>3</sup>. Demand has fallen for all other sources of electricity, including coal, gas and nuclear power (IEA 2020b). However, increased offshore wind capacity in 2020 has more than made up for a slowdown in investments (across other renewable technologies) after the outbreak of COVID-19 (IEA 2020a). There is some uncertainty in growth projections for the offshore wind sector beyond 2021, due to permitting and other approval delays caused by COVID-19. In addition, the sectors' interconnectedness amplifies the impacts discussed across the ocean economy (Box 1 and Figure 1).

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2. Ocean tourism before COVID-19 was directly valued at US\$390 billion globally and comprises a significant portion of many nations' GDP (OECD 2016).

3. However, renewable sources (mainly wind and solar) saw their share of electricity substantially increase during COVID-19. For example, in less than 10 weeks, the United States increased its renewable energy consumption by nearly 40 percent and India by 45 percent. The ongoing increase in renewable energy into the grid results from a mixture of past policies, regulations, incentives and innovations embedded in the power sectors of many forward-thinking countries (Mojarro 2020).

## Box 1. Interwoven Impacts across the Ocean Economy and the Rest of the Sectors

There are strong interconnections between ocean sectors and land-based economies. For example, fisheries and aquaculture provide employment to many communities and are vital for the food security of both coastal and inland communities<sup>a</sup>. The global maritime shipping industry carries around 90 percent of traded goods. In coastal areas, the tourism sector is the biggest contributor to local, regional and national GDP. Because of these interconnections and linkages between ocean-based sectors and land-based economies, impacts of COVID-19 flow beyond these individual sectors with amplified consequences for the entire economy. Some examples of the transmission of impacts across sectors are discussed below.

### **Disruption to maritime shipping and port services has negative consequences for the seafood, agriculture, energy, health and tourism sectors.**

- Delays for fishing vessels in ports are associated with increased risk of higher seafood waste (Saumweber et al. 2020).
- Port closures (or restricted access to ports) in some countries may have increased the use of transshipment—the transfer of fish and supplies from one vessel to another in open waters—which is more likely to be associated with illegal, unreported and unregulated (IUU) fishing and human rights violations.
- Port closures and travel restrictions also severely harm the global cruise tourism industry, leaving many tourists and seafarers unable to disembark from vessels and replacement crews unable to join their ships.
- The ability of the shipping sector to provide uninterrupted service to transport food, energy and other essentials, such as medical supplies, across the continents will play a critical role in overcoming this pandemic.

### **The aquaculture sector and its ancillary business supply chains face setbacks due to international trade delays, restaurant and hotel closures, and reduction in fishing effort.**

- Lockdown restrictions on fishing operations have disrupted the production of fishmeal and fish oil (FMFO) from wild caught fisheries, with negative consequences for the aquaculture sector that is dependent on this input as feed (FAO 2020b).
- At the same time, trade delays are leading to higher unsold volumes of farmed live fish, resulting in higher feeding costs for the aquaculture sector. The risk of fish mortality is also increased, especially in situations where key inputs are in low supply (such as FMFO requirements) (FAO 2020b).
- Reduced tourist visits caused by lockdown measures have heavily disrupted demand for seafood from the hotel and restaurant industry, particularly for high-value species such as lobster and prawn, reinforcing the interdependencies between the tourism, fisheries and aquaculture sectors (UN 2020c).

### **Ocean conservation and research have decreased as a result of falling tourism revenues, lost livelihoods in coastal communities and increased ocean pollution.**

- In some locations, particularly low- and middle-income countries, fewer tourist visits and reduced availability of associated revenues have curtailed the availability of funding for fisheries management and marine conservation measures (Greenfield and Muiruri 2020).
- Coastal fisheries and reefs are also facing greater pressure, as local communities are turning back to traditional fishing as a food source—driven by a loss of income from tourism (Vyawahare 2020). This can be exacerbated when people return to their home communities from urban areas (Hockings et al. 2020).



## Box 1. Interwoven Impacts across the Ocean Economy and the Rest of the Sectors, continued

**Ocean conservation and research have decreased as a result of falling tourism revenues, lost livelihoods in coastal communities and increased ocean pollution (continued).**

- The work of ocean research vessels has been impaired by port closures and quarantine restrictions, with knock-on effects for ocean science and climate studies, such as the Alfred Wegener Research Institute Polarstern expedition, although some privately funded research missions have continued (e.g. Walsh Challenger Deep dive).
- Increased production and use of single-use plastic (such as for e-commerce shipping, grocery delivery, additional food layer protection, masks, gloves and other personal protective equipment) have increased plastic pollution

in the ocean, since these items often are not properly disposed of (Tenenbaum 2020). Ocean pollution also has increased due to disruption of land-based waste collection and recycling facilities during COVID-19, especially in South and East Asia<sup>b</sup>.

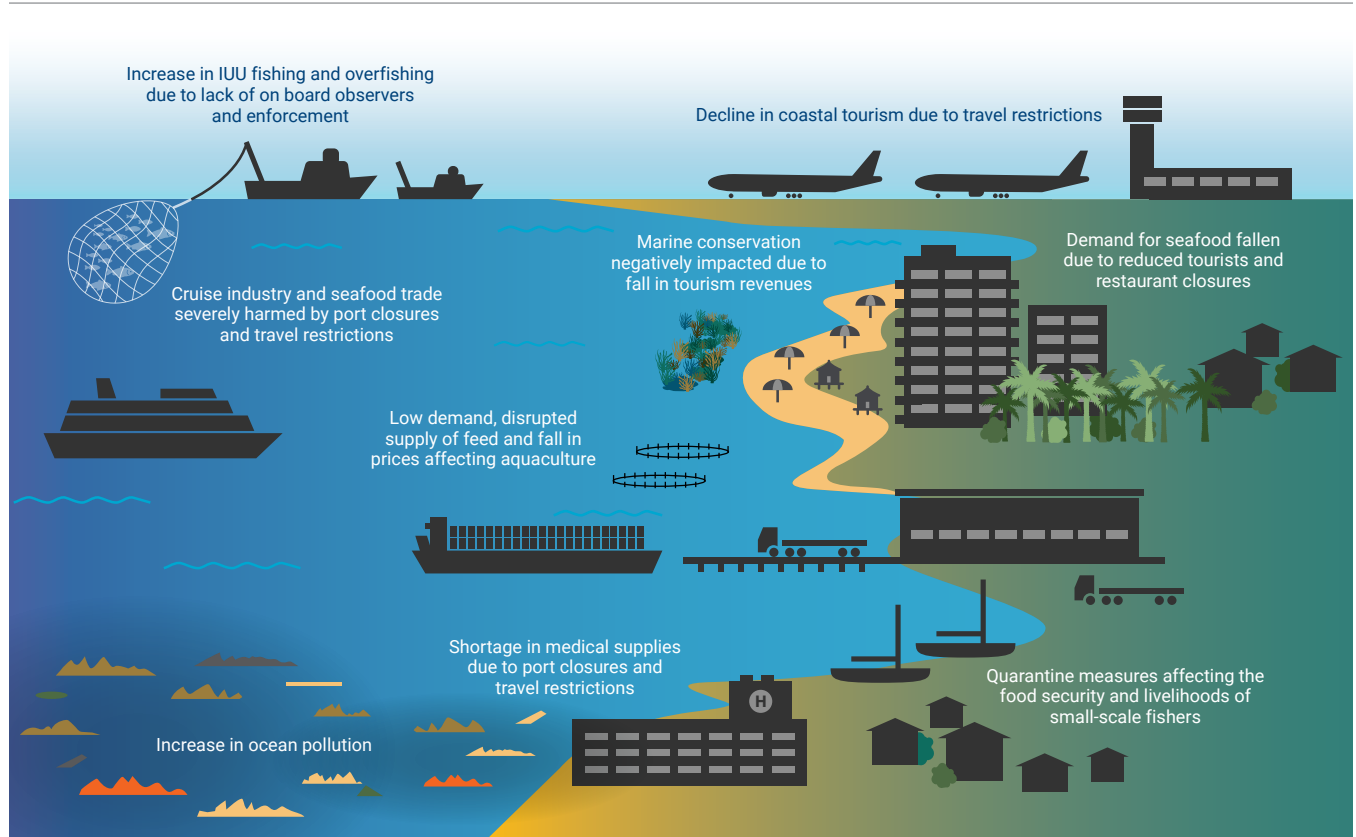
**Reduced access to markets for small-scale fishers weakens the food security of entire local communities.**

- Reduced inland ferry services and quarantine measures have restricted the ability of many small-scale fishers to access local markets, sell their harvest and contribute to the local economy and the food security of their community.

<sup>a</sup> Fish accounted for about 17 percent of animal protein consumed by the global population (FAO 2020c).

<sup>b</sup> With recycling not recognised as an essential service in many countries, less than 20 percent of recyclers operated during the lockdowns in Vietnam, India and the Philippines, while in Thailand and Indonesia it was less than 60 percent, significantly curtailing waste collection in cities (Circulate Capital and GA-Circular 2020). Critical workers in the value chain lost jobs and income to support their families. The migration of workers in these countries (from urban to rural areas) has also reduced waste collection and recycling. For example, in India, 70–80 percent of informal sector waste workers have left cities for their hometowns (Circulate Capital and GA-Circular 2020). As a result, no waste-picking has been occurring in landfills and dumping grounds for India's five largest cities.

**Figure 1.** Interwoven Impacts Across the Ocean



Source: Authors.

## Social impact

Assessments of social impacts show that the COVID-19 crisis has disproportionately harmed a number of vulnerable groups, including women employed in temporary jobs, low-skilled workers, small-scale fishers and businesses, Indigenous community members and younger workers.

Women represent the majority of the workforce in the ocean economy sectors hardest hit by the crisis—about 50 percent of workers in the seafood sector<sup>4</sup>, 70 percent

in aquaculture, 80–90 percent in the post-harvest sector of small-scale fisheries<sup>5</sup> and 54 percent in tourism (Holmyard 2020; UNWTO 2019; Monfort 2015; World Bank 2012; OECD 2015). As businesses lose revenue, many will reduce their costs by laying off workers, starting with the temporary and casual jobs disproportionately occupied by women (Holmyard 2020) (Box 2)<sup>6</sup>. The shipping industry (including the cruise sector) has been particularly badly affected due to the suspension of cruise operations and quarantining of workers (ILO 2020a; UNCTAD 2020b), with seafarers' physical and mental well-being at risk.

4. When considering fisheries, aquaculture, seafood processing and all related services.

5. Of the 120 million people who work in the capture fisheries and post-harvest sectors, 47 percent are women. If the People's Republic of China is excluded, the share of women fishers and fish workers approaches 60 percent (World Bank 2012).

6. Other systemic barriers such as gender-based violence and lack of access to finance and credit further contribute to the impacts faced by women when they are laid off work. In addition, in many countries women tend to have more work at home, raising children and taking care of the elderly and the sick. An increase in domestic violence and conflict within households could increase food insecurity for vulnerable groups (Farrell et al. 2020).

The reduced demand, limited accessibility of markets and collapsed prices of some fisheries have curtailed small-scale fishers' ability to pursue their livelihoods. Indigenous communities are particularly at risk as they may have reduced immunity and limited access to healthcare (UN DESA 2020a)<sup>7</sup>. These groups also face risks of lost livelihoods resulting from the economic crisis, as many are employed in the informal sector or engaged in seasonal work (such as tourism), in which they do not receive social protection benefits<sup>8</sup>. As for all sectors, young people, low-skilled workers and informal workers across the ocean-based economy have been disproportionately affected by the COVID-19 crisis (ILO 2020c, 2018; World Bank 2020a)<sup>9</sup>.

Across the seafood supply chain, the social and financial resilience of small businesses (including ones that are family owned or whose workers are self-employed) is being weakened by labour shortages and low demand (Resilience 2020).

The severity of the impacts also varies across countries, with the economies of small island developing states (SIDS) facing higher economic risk (Table 1 and Box 2) given their small economic base, high degree of openness and extreme dependence on the economic performance of a few developed economies (UN 2020a; WTTC 2020).

The crisis has had some positive social consequences at a community level, such as stronger ties within communities, as demonstrated by many instances of food-sharing (Table 1), and by examples of community-run savings clubs to improve social and financial resilience in fishing-dependent communities throughout the Philippines (Arquiza 2019; Polo 2020)<sup>10</sup>. However, social cohesion and trust in authorities has also declined in some communities due to poor crisis management at all government levels.

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7. *The impact of COVID-19 on Indigenous elders has cultural implications for their communities, as elders play a key role in keeping and transmitting Indigenous traditional knowledge, culture and practices. These include conservation of biodiversity, upholding traditions and customs, leading community gatherings and ceremonies, and serving as custodians of customary law and governance (UN DESA 2020a).*

8. *Indigenous people account for almost 19 percent of the extreme poor, irrespective of the region and residence in rural or urban areas and even across international borders. They are custodians of a wealth of traditional knowledge and practices, languages and culture, which includes time-tested responses to crises (UN DESA 2020a).*

9. *More than 61 percent of the world's employed population—2 billion people—earn their livelihoods in the informal sector. These workers lack the right to social protection benefits and schemes. Some of the low-skill workers in these sectors are migrant workers. The combination of the decline in economic activity, travel restrictions and lack of social protection in many migrant hubs induces such low-skilled migrants to seek to return home. However, back home returnees continue to face challenges, including lack of employment opportunities, limited access to social safety nets, large debts accumulated to finance migration (costs that would have been paid with higher incomes earned at the destination), loss of remittances from abroad and even discrimination by community members fearful that migrants may transmit COVID-19. Young people face multiple shocks from the COVID 19 crisis, including job loss, disruption to education and training, and increased challenges to entering the labour market. A large proportion of young workers are employed in the hard-hit sectors (including tourism), and almost 77 percent of the world's young workers are in informal jobs (compared to around 60 percent of workers aged 25 and above) (ILO 2020c).*

10 *Women make up the majority of members in savings clubs (~70 percent) and help fishing households pivot from quick spending to long-term financial planning. This change in behaviour can powerfully affect the long-term strategy behind coastal fisheries conservation and the goal of ending overfishing. The savings clubs have already proved to be a fast, secure and communal way to ensure food security for the community during the COVID-19 lockdowns.*

## Box 2. Tourism Impact in Small Island Developing States

Due to the economic crisis caused by COVID-19, small island developing states (SIDS) as a whole have seen a 25 percent decline in tourism receipts, resulting in a US\$7.4 billion or 7.3 percent fall in GDP (Coke-Hamilton 2020)<sup>a</sup>. The gross domestic product (GDP) of the Bahamas and Palau is expected to shrink by 8 percent or more, making the current crisis the worst in recorded history, while the drop in GDP could reach 16 percent in the Maldives and Seychelles (Coke-Hamilton 2020; UN DESA 2020b). High external debt, low foreign reserves and volatile capital flows have increased the severity of the pandemic's economic consequences for many SIDS (Coke-Hamilton 2020). This has had a severe impact on both direct and indirect employment (Coke-Hamilton 2020). In the Pacific and Caribbean islands, which rely heavily on tourism, hotels and resorts have been badly affected. For example, the Fiji Hotel and Tourism Association reports that 279 hotels and resorts have closed since the outbreak, with 25,000 workers losing their jobs (ILO 2020b).

### Impact on women in tourism

In 20 of 28 SIDS, women constitute more than half of those employed in the accommodation and food services sectors, the core economic activities related to tourism. Women in this sector and in these countries are also more likely than other women to own small and medium businesses. Given the female-intensive nature of employment in tourism, especially in low-skilled activities, women in SIDS are more likely than men to lose their jobs. Businesses may also choose to lower wages or shift workers to informal or part-time work, worsening the already unclear terms of employment in tourism. In addition, women face higher barriers to access business credit. In the absence of targeted policies, this means women entrepreneurs in tourism face a higher risk of bankruptcy than their male counterparts (Zarrilli and Aydiner-Avsar 2020).

<sup>a</sup> According to the World Development Indicator database, tourism provides more than 50 percent of export revenue in 20 SIDS and more than 30 percent in 29 SIDS (Zarrilli and Aydiner-Avsar 2020).

## Environmental impact

Overfishing, pollution and biodiversity loss were eroding the ocean's ability to sustain livelihoods before COVID-19. The pandemic is likely to intensify the severity of these threats to the ocean. Decreased presence of law enforcement, a slowdown in key international negotiations (such as talks on fisheries subsidies at the World Trade Organization) and the roll-back of environmental regulation are likely to compromise ocean sustainability. For example, suspension of observer programs and fishing patrols may be leading to an increase in IUU fishing (Thomson 2020; CFFA

CAPE 2020). Similarly, roll-back measures such as reassignment of new artisanal fishing quotas and rollover of uncaught quota have been reintroduced, which could reverse progress made in fish stock recovery (Australian Government 2020b). However, the policy response varies greatly from one country to the next and across levels of government<sup>11</sup>. Declining tourism revenue is also weakening conservation and restoration efforts, especially in cases where ecotourism provides the revenue stream for monitoring, data-gathering, conservation, certification and environmental education (see Box 3). Table 1 gives details of these impacts.

11. For example, while we see the roll-back of many national-level environmental policies, some local-level governance approaches have used consultation to institute recovery plans for fisheries and aquaculture. One example is the virtual consultation by the Philippine Council for Agriculture and Fisheries with relevant stakeholders and government officials specifically to discuss issues confronting the fishery and aquaculture sector amid COVID-19 (PCAF 2020).



In addition, COVID-19 has had a temporary impact on efforts to ensure the sustainable transition of ocean-based sectors<sup>12</sup>. However, the ambition to have a carbon-neutral fleet by 2050 is still active, as demonstrated in the Norwegian Shipowners' Association climate strategy, the net-zero announcement by CMA CGM, the Mærsk Foundation donation to set up a new green technology research institute, as well as a number of large-scale projects involving energy companies (such as the partnership by Ørsted, Mærsk and others) to produce green methanol for shipping (NSA 2020b; Mærsk 2020; CMA CGM 2020)<sup>13</sup>.

While the decline of ocean-based activities, such as fishing<sup>14</sup> and ocean-based tourism<sup>15</sup>, has offered temporary relief to marine ecosystems, over the coming months the combined effects of increased food insecurity, reduced presence of law enforcement bodies and economic recession could prevent the environmental benefits of decreased commercial maritime activities from being fully realised (Torgler et al. 2020)<sup>16</sup>.

### Box 3. Decline in Funding for Marine Conservation Due to Loss of Tourism Revenue

In many cases, governments use revenue from marine tourism to fund marine research and conservation efforts (Wilson and Tisdell 2003) and undertake monitoring and protection activities in marine protected areas. For example, in the Philippines' Tubbataha Reefs Natural Park, tourism revenues make up over half of the conservation budget needed to protect areas from illegal fisheries (UNESCO 2020). However, as the main tourism season (normally April and May) coincided with the strictest quarantine restrictions during the COVID-19 period, tourism revenues in Tubbataha have dropped sharply.

With the decline in tourism revenues during COVID-19, some sites have turned to crowdfunding, online donations and government grants (where available) to meet the funding gaps. In some cases, private foundations have stepped in to compensate for reduced revenue from tourism and endowments. However, these funding sources are unlikely to be sustained. Others have had to reduce surveillance and/or downscale restoration programmes, leading to an increase in fishing pressure. For example, in Seychelles, Fiji, Indonesia, the Philippines and Hawaii, there are reports of increasing fishing pressure in marine protected and conserved areas, which is encouraged by a reduced management presence (Hockings et al. 2020).

12. A survey of its members performed by the European Community Shipowners' Associations revealed that COVID-19 may negatively affect efforts to decarbonise the shipping industry (ESCA 2020). Responding to a general question about investments in reduction of greenhouse gas emissions, 44 percent of respondents to the survey said it will no longer be possible to return to the investments planned prior to the pandemic. Only 26 percent of respondents to the survey thought they would return to the same level of investments, whereas 30 percent thought the investments would still happen, but to a lesser extent (ESCA 2020)

13. Since decarbonisation of shipping is a full value chain endeavour, effort towards this transition should not be limited the shipping companies.

14. The lockdown and labour shortages have resulted in a decrease in global fishing activity of nearly 10 percent (Clavelle 2020). In some regions this could provide temporary relief to recovering fish populations and some possible benefits for small-scale fisheries in the longer run (Jigeesh 2020; John 2020).

15. A potential positive outcome for marine ecosystems as a result of the decline in tourism activities (e.g. reef trampling, anchor damage, etc.) is less sewage from tourist centres (Zakai and Chadwick-Furman 2002).

16. Emissions reductions caused by economic downturns tend to be temporary—and can lead to emissions growth as economies attempt to get back on track. After the global financial crisis of 2008, for example, global CO2 emissions from fossil fuel combustion and cement production grew 5.9 percent in 2010, more than offsetting the 1.4 percent decrease in 2009.

**Table 1.** Summary of Impacts across Ocean-Based Sectors and Ecosystems

● Negative impacts ● No/neutral impacts ● Positive impacts

SECTORS	ECONOMIC IMPACT	SOCIAL IMPACT	ENVIRONMENTAL IMPACT
<b>Coastal and marine tourism</b>	<ul style="list-style-type: none"> <li>● The loss in gross value added is estimated to be up to US\$2.1 trillion for the whole of the tourism sector, with 100 million jobs at risk (UNCTAD 2020b).</li> <li>● Coastal regions are expected to be the most affected, and the cumulative reduction in gross domestic product (GDP) from April to June is estimated to be between €9.7 billion to €24.9 billion for areas in Europe alone (OECD 2020b).</li> <li>● Small island developing states have seen a decline in tourism receipts of 25%, resulting in a \$7.4 billion loss (or a 7.3% fall in GDP) (Coke-Hamilton 2020).</li> <li>● For the Caribbean, analysis estimates job losses to be 1.4 million to 2 million and losses to the tourism sector to be \$27 billion to \$44 billion (WTTC 2020).</li> <li>● Recovery is estimated to take a minimum of 10 months to two years after the pandemic, and longer for smaller economies reliant on tourist arrivals from a few developed economies (UNCTAD 2020b).</li> </ul>	<ul style="list-style-type: none"> <li>● Small and medium enterprises, autonomous workers and workers from vulnerable communities, who constitute 80% of the coastal tourism sector workforce, have been hard hit by the reduced flow of income.</li> <li>● Seafarers from the cruise industry have been badly affected due to suspension of cruise operations and quarantining of workers and passengers (ILO 2020a; UNCTAD 2020b).</li> <li>● Unemployment is significantly higher in the Pacific islands and Caribbean, which rely more on tourism revenues (ILO 2020a).</li> <li>● Women are likely to be most affected by job losses in the tourism sector (based on the proportion of women employed in low-skilled jobs in the sector).</li> </ul>	<ul style="list-style-type: none"> <li>● The reduction in tourism revenues could have a knock-on impact on conservation and restoration efforts (MPA News 2009).</li> <li>● The reduction in tourism activities provides a temporary respite to reef ecosystems (Zakai and Chadwick-Furman 2002).</li> </ul>

**Table 1.** Summary of Impacts across Ocean-Based Sectors and Ecosystems, continued

● Negative impacts ● No/neutral impacts ● Positive impacts

SECTORS	ECONOMIC IMPACT	SOCIAL IMPACT	ENVIRONMENTAL IMPACT
<b>Marine transport</b>	<ul style="list-style-type: none"> <li>● The cancellation of shipping is estimated to be causing revenue losses of \$1.9 billion for the carriers (World Maritime News 2020).</li> <li>● The outbreak is costing the liner segment of the global shipping industry around \$350 million a week in lost volume (ICS 2020a; Paris 2020).</li> <li>● With 384 sailings cancelled, the first half of 2020 could see a 25% reduction in shipping, with a 10% annual fall in 2020 (World Maritime News 2020). For all ships, departures in the first week of April 2020 were down 20% compared to 2019, while the decrease in container-ship departures was 29% (Heiland and Ulltveit-Moe 2020).</li> <li>● The shipbuilding sector has sustained a major blow from production halts, temporary layoffs and liquidity issues—particularly in the European Union.</li> <li>● The drop in demand for new ships may lead to reductions in shipyard activity.</li> </ul>	<ul style="list-style-type: none"> <li>● Travel restrictions and grounded airplanes make crew changeover impossible, leading to repeated contract extensions. About 200,000 seafarers have overrun their contracts and another 200,000 are now waiting to get on board (ICS 2020b). This is putting the personal safety, physical and mental health of seafarers at risk (IMO 2020; ILO 2020a; UNGC 2020a; ICS 2020a) and could lead to maritime accidents.</li> <li>● Seafarers stuck at sea due to crew change restrictions are prevented from reuniting with families (UNGC 2020a; IMO 2020; ILO 2020a).</li> <li>● Crew members are often denied medical treatment by foreign authorities during the quarantine period (ICS 2020b; IMO 2020).</li> </ul>	<ul style="list-style-type: none"> <li>● Short-term environmental benefit might be observed due to lower transport demand.</li> <li>● Due to weak markets, several shipping companies are now considering scrapping excess tonnage (NSA 2020a). This could present an opportunity to get rid of older and more polluting tonnage.</li> <li>● Although the shipping sector’s capacity to invest in more environmentally friendly technologies has been reduced (ECSA 2020), there is still a strong drive towards decarbonisation, as seen in recent announcements from the industry (NSA 2020b; Mærsk 2020; CMA CGM 2020).</li> <li>● COVID-19 has curtailed the ability of the International Maritime Organization to have physical meetings, which may lead to delays in the adoption of regulations necessary to achieve environmental targets and a reduction in ambition among governments (long-term risk).</li> <li>● An increase in loss and waste throughout the seafood supply chain as a result of an increase in quarantine paperwork and reduced personnel at the docks (Saumweber et al. 2020).</li> </ul>

**Table 1.** Summary of Impacts across Ocean-Based Sectors and Ecosystems, continued

● Negative impacts ● No/neutral impacts ● Positive impacts

SECTORS	ECONOMIC IMPACT	SOCIAL IMPACT	ENVIRONMENTAL IMPACT
<b>Wild capture fisheries</b>	<ul style="list-style-type: none"> <li>● Global fishing activity has dropped by 10% since 11 March (Clavelle 2020)<sup>a</sup>. The impact has been even more significant for small-scale fishers (Campbell et al. 2020).</li> <li>● Sales and prices have fallen for premium seafood products generally sold to restaurants, such as lobster, crabs, scallops and wild salmon (Saumweber et al. 2020).</li> <li>● Export-oriented fisheries have seen a vast reduction in demand (particularly from Asia, the United States and Europe) as well as port closures, lost access to cold storage and cessation of shipping and air freight (Orlowski 2020).</li> <li>● Demand has increased for non-perishable compared to fresh seafood (UNCTAD 2020b).</li> </ul>	<ul style="list-style-type: none"> <li>● Female employment may benefit from the production shift towards female-intensive occupations such as preserving and freezing (UNCTAD 2020b).</li> <li>● The reduced demand, limited accessibility of markets and collapsed prices of some fisheries have restricted small-scale fishers' ability to pursue their livelihoods and food security.</li> <li>● Women working in the processing sector may be more likely to lose their jobs due to the sector's tendency to offer temporary and lower-paid positions without social protection benefits (Orlowski 2020; The Fish Site 2020).</li> <li>● Gender-based violence may increase (Harper et al. 2020).</li> <li>● Fishing communities may become 'hotspots' for rapid infection due to the migratory nature of fishers and the frequency of international visitors (FAO 2020a).</li> <li>● Probable major disruptions to regionally important tuna industry in the Pacific islands will impact national access to tuna, with resulting economic consequences (Farrell et al. 2020).</li> <li>● Local processing of tuna may be disrupted, and shortages of imported processed and packaged foods are possible (tinned foods). SMEs in this sector could be particularly affected (Farrell et al. 2020).</li> </ul>	<ul style="list-style-type: none"> <li>● A decline in fishing pressure, particularly by legal industrial fleets, could allow fish stocks with more resilient life histories to recover (Bennett et al. 2020).</li> <li>● Illegal, unreported and unregulated and (IUU) fishing may increase due to the suspension of observer programs and fishing patrols.</li> <li>● Increased pressure on supply chains, due to port closures and restricted access, may lead to harder-to-regulate practices such as increased transshipment of fish at sea. Such activities are more likely to be associated with illicit fishing and human rights violations (Saumweber et al. 2020).</li> <li>● The sustainability of stocks may be compromised by the extension of fishing seasons and the halting of stock assessment surveys (Carr 2020).</li> <li>● Negotiations on fisheries subsidies at the World Trade Organization have been forced onto a slower track (GSI 2020).</li> </ul>

<sup>a</sup> These figures primarily represent changes in activity for the world's industrial fleet—fishing vessels over 24 metres—and do not fully capture the impacts on small-scale fisheries.



**Table 1.** Summary of Impacts across Ocean-Based Sectors and Ecosystems, continued

● Negative impacts ● No/neutral impacts ● Positive impacts

SECTORS	ECONOMIC IMPACT	SOCIAL IMPACT	ENVIRONMENTAL IMPACT
<b>Aquaculture</b>	<ul style="list-style-type: none"> <li>● Production may be affected by the disruption in the supply of feed or input, transportation and labour shortages.</li> <li>● Specialty aquaculture products like shellfish (e.g. lobster, shrimp and oysters) are hardest hit by restaurant closures (FAO 2020b).</li> <li>● Flight cancellation has directly affected trade in some high-end fresh products that are transported by air (FAO 2020b).</li> <li>● The sale of prepackaged, frozen or canned fish and fish products has increased in the short term due to panic buying. However, these industries may not be able to continue supplying the market if the raw material (such as feed) is not available (Aquafeed 2020).</li> </ul>	<ul style="list-style-type: none"> <li>● COVID-19 outbreaks have occurred among seafood process workers in Ghana, the United States and elsewhere, as well as in other animal processing plants (Love et al. 2020).</li> <li>● Women, who comprise a disproportionate share of temporary and casual workers, face the highest risk of losing their jobs due to falling business revenues (Holmyard 2020).</li> <li>● Women working or shopping in vendor markets are at greater risk of infection, since these locations have limited sanitation and hygiene facilities (FAO 2020a).</li> </ul>	<ul style="list-style-type: none"> <li>● Delays in trade are forcing fish farmers to sit on stocks of live fish for prolonged periods, increasing demand for fishmeal and fish oil containing aquafeed (FAO 2020a). This could increase pressure on forage fisheries that are predominantly used for aquafeed production.</li> </ul>
<b>Ocean-based renewable energy</b>	<ul style="list-style-type: none"> <li>● Offshore wind energy has seen significant growth during COVID-19 (reNews 2020).</li> <li>● The forecast for offshore wind remains unchanged for 2021, as most projects are already financed and under construction (IEA 2020a). Beyond 2021, the industry might be affected due to permitting and other approval delays caused by COVID-19.</li> </ul>	<ul style="list-style-type: none"> <li>● It is difficult to get specialised personnel on board offshore energy platforms or into ports to undertake operations, maintenance and repair, leading to increased risks to health and safety (UNGC 2020a; IMCA 2020).</li> <li>● Though this is hard to disaggregate by sector or technology, some analysis shows that there could be regional job losses in the clean energy sector (Jordan 2020)<sup>b</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>● Falling energy demand means sharp reductions in the growth of installed wind, solar and battery capacity in 2020, with effects lingering into 2021 (Eckhouse and Martin 2020)<sup>c</sup>.</li> <li>● However, offshore wind investment has more than made up for a slowdown in investment in onshore wind and solar farm projects after the outbreak of COVID-19 (Ambrose 2020)<sup>d</sup>.</li> </ul>

<sup>b</sup> 15 percent of the U.S. total clean energy workforce could be lost over the coming months (more than half a million jobs) due to COVID-19. In March alone, more than 106,000 renewable energy and energy efficiency jobs were lost in the country (Jordan 2020).

<sup>c</sup> 2020 global solar and energy storage installations are expected to drop nearly 20 percent compared to pre-COVID-19 projections (Energy Choice Coalition 2020).

<sup>d</sup> Bloomberg New Energy Finance believes that offshore wind projects are taking off despite the global economic gloom in part due to a two-thirds fall in cost since 2012 and a rush in China to finance and build offshore wind projects before the government's subsidy regime expires at the end of 2021.

**Table 1.** Summary of Impacts across Ocean-Based Sectors and Ecosystems, continued

● Negative impacts ● No/neutral impacts ● Positive impacts

SECTORS	ECONOMIC IMPACT	SOCIAL IMPACT	ENVIRONMENTAL IMPACT
<b>Marine conservation</b>	<ul style="list-style-type: none"> <li>● Reduced revenues from tourism have affected the functioning of some conservation organisations that relied on ecotourism for funding. This has forced these organisations to reduce costs, including by reducing staff engaged in monitoring (Riedmiller 2020).</li> </ul>	<ul style="list-style-type: none"> <li>● Locals and Indigenous communities have turned to hunting and fishing for food security (due to job and income loss), rather than relying on food commodities sold in the markets (Bowlin 2020). In some instances, this could affect the conservation of nearshore reefs close to urban areas.</li> <li>● Nature-based solutions for marine ecosystems, such as the protection of mangroves, are receiving increased attention for their contribution to global efforts like the Sustainable Development Goals and the Paris Agreement, for their co-benefits of protecting and restoring coastal ecosystems to strengthen food security and for their provision of sustainable ‘goods and services’ that improve social, economic and ecological resilience to climate change and COVID-19.</li> </ul>	<ul style="list-style-type: none"> <li>● Marine ecosystems (e.g. coral reefs) may benefit from the reduced physical impact of tourism activities and reduced sewage from hotels and restaurants. Polyethylene terephthalate bottle consumption may be reduced by the cancellation of mass events, tourism and travel (Circulate Capital and GA-Circular 2020).</li> <li>● Poaching and IUU fishing may increase due to roll-back of environmental protection measures (Kroner 2020). Other impacts may include reversion to unsustainable practices such as destructive fishing or mangrove clearing.</li> <li>● Environmental deregulation measures include extension of the fishing season, opening of marine protected areas to fishing (SUBPESCA 2020c, 2020a, 2020b; Carey y Cía 2020), reassignment of new artisanal fishing quotas and rollover of uncaught quota (Australian Government 2020b).</li> <li>● The temporary roll-back on plastic bans may become permanent, which is likely to increase plastics in the ocean (Leonard and Mallos 2020)<sup>e</sup>. Marine plastic pollution in the ocean has increased due to the worker shortages in the informal waste sector, lack of demand for recycled plastics and lack of proper disposal of medical items such as masks.</li> </ul>

<sup>e</sup> Several governments, such as that of the Indian state of Tamil Nadu, have suspended bans on single-use plastic bottles and bags in retail trade (Peszko 2020). The United Kingdom has suspended the plastic bag charge for online deliveries, with Scotland delaying the introduction of a packaging deposit-return scheme (Peszko 2020).

## 2.2 Emerging Responses

This section summarises the government policy responses announced thus far to absorb and react to COVID-19 disruptions to the ocean economy and the actions taken by development banks, international organisations (IOs), non-governmental organisations (NGOs) and the private sector to transition towards a sustainable ocean economy.

### National governments

#### RAPID EMERGENCY RESPONSE

To date, response packages from governments have amounted to approximately US\$10 trillion globally (IMF 2020a)<sup>17</sup>. As a part of the immediate response, governments have prioritised saving lives and protecting livelihoods, with money channelled directly to households and those on the frontlines of the pandemic. For the ocean economy, this means protecting vulnerable coastal communities dependent on marine natural resources, ocean economy workers, small and large-scale businesses, and ensuring that supply chains remain open for delivery of essential goods (Box 4).

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17. The majority of the \$10 trillion constitutes rapid emergency response for the short term and focuses on mostly fiscal measures and regulatory or deregulatory measures.



## Box 4. Economic Relief for Ocean Economy Workers and Businesses

A number of measures were introduced by countries to support workers, vulnerable groups and small businesses. Some governments, such as those of the United Kingdom and Canada, along with the EU Commission, have also classified ocean workers as 'key workers', thereby giving them right to movement (EU Commission 2020d; UK Government 2020; Government of Canada 2020).

The list below is not exhaustive but provides examples of support measures directed towards income protection and the welfare of ocean-economy workers.

- **Coastal tourism** Measures include extension of loans and credit to businesses, wage subsidy to workers, financial relief to businesses such as loan consolidation and term extension, increased promotion of tourism and strengthened regional cooperation to boost tourism (e.g. by the Association of Southeast Asian Nations) (Office of the Prime Minister, Canada 2020; KPMG 2020).
- **Marine transport** Staff (especially onshore) have been covered by general wage support schemes in many countries. A number of countries have agreed to new international measures to open up foreign borders for seafarers and increase the number of commercial flights to expedite repatriation following an international crew change summit (Chambers 2020a)<sup>a</sup>. There have also been a number of government support measures and bailouts for maritime companies.
- **Wild capture fisheries** Measures include grants and financial compensation for workers and small-scale businesses and enterprises (in the harvesting, processing and artisanal fishing sector), increased state aid (European Commission 2020b), online training programmes, provision of new fishing equipment, refrigeration transport service for seafood caught by artisanal fisher organisations (e.g. a pilot programme in Chile), provision of loans at subsidised interest rates, waiver of government fees associated with licenses, rollover of quota and deferral of income tax for small businesses (SUBPESCA 2020d; IKI 2020). The European Union also provides a US\$1.2 billion guarantee from the EU budget to the European Investment Bank so that it can incentivise European banks and mobilise about \$9.3 billion of working capital financing for small and medium enterprises in the fisheries, aquaculture and seafood services sectors (European Commission 2020b).
- **Aquaculture** Measures include income support to workers, increased funding to double community-based aquaculture production and loans or credits to seafood processors (EU Commission 2020a). In addition, the EU Commission, in response to stakeholders' requests, adopted new measures for the aquaculture sector, including support to farmers for temporary suspension of production, and support to producers for private storage of aquaculture products.

<sup>a</sup> The 13 countries to agree this are Denmark, France, Germany, Greece, Indonesia, the Netherlands, Norway, the Philippines, Saudi Arabia, Singapore, the United Arab Emirates, the United Kingdom and the United States, all of whom now recognise seafarers as key workers.

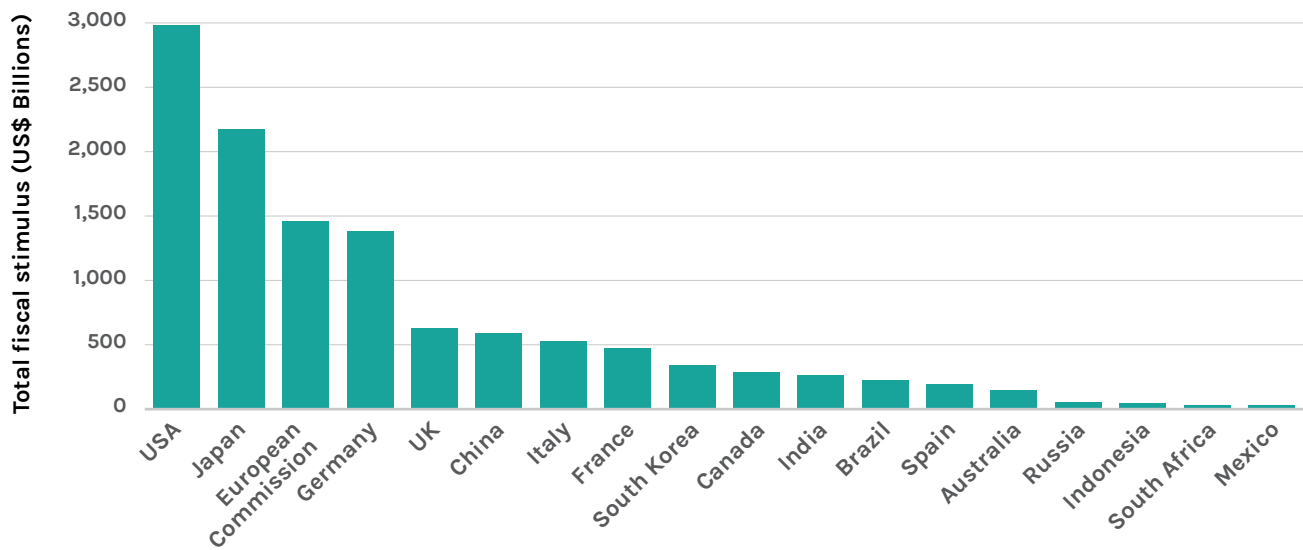


### LONG-TERM RECOVERY RESPONSE MEASURES

The second phase of response from national governments will be aimed at measures to promote longer-term economic recovery and resilience. Analysis from McKinsey shows that G20 nations have announced fiscal measures averaging 11 percent of GDP, which is estimated to be three times the response to the 2008–9 financial crisis (McKinsey 2020). The United States has announced the largest fiscal stimulus package, followed by Japan and the European Union (Figure 2). Some countries, such as Italy, have said they will commit up to 40 percent of GDP to their economic stimulus packages (McKinsey 2020)<sup>18</sup>.

So far, 30 percent of economic stimulus packages are going to sectors that currently have high environmental impact (Vivid Economics 2020)<sup>19</sup>. Within the 30 percent, it is estimated that the majority of the spending will have a predominantly brown impact without conditionality for performance improvements in these sectors<sup>20</sup>. Some of these ‘brown’ measures include unrestricted support to sectors that have proved to be environmentally harmful in the past and also include roll-back on various environmental regulations implemented to deliver better environmental outcomes. For example, both the transport and industry sectors have been hit hard by the crisis and are receiving substantial support from governments. Another source estimated that more than

**Figure 2.** Announced COVID Response Fiscal Stimulus Package by Country



Note: Assumes the proposed ‘Next Generation EU’ recovery package is implemented in full.

Source: Vivid Economics Data.

18. Fiscal measures are likely to be just one aspect of the response measures—monetary measures will also be key in stimulating demand and much-needed liquidity in the market. Assessing the impact of these measures (such as quantitative easing measures) on the ocean economy is beyond the scope of the analysis.
19. Economic stimulus packages encompass a range of fiscal mechanisms, including bailouts and loans. In defining the amount of stimulus flowing through to sectors with a high environmental impact, the index has removed any measures which are purely devised to provide income support to workers (e.g. furlough or income protection programmes).
20. Estimated by Vivid Economics (2020) based on the 14 of 18 countries it evaluates in its study. Brown orientation of these countries’ stimulus funding based on (1) the scale of funds flowing into environmentally intensive sectors, (2) the existing green orientation of those sectors and (3) the efforts which steer stimulus toward (or away from) pro-environmental recovery.

half a trillion dollars worldwide—\$509 billion (£395 billion)—is to be poured into high-carbon industries, with no conditions to ensure that they reduce their carbon output (Harvey 2020)<sup>21</sup>. In contrast, only about \$12.3 billion is to go towards low-carbon industries, such as renewable energy, and a further \$18.5 billion is intended for high-carbon industries provided they achieve climate targets (Harvey 2020).

Some of these interventions target the ocean economy and even fewer align with a transition towards a sustainable ocean economy (Table 2 and Section 2.3). At this stage, there is little information on how these high-level interventions and investments will be implemented and the degree to which they advance priorities for the sustainable ocean economy or undermine such progress.

**Table 2.** Examples of Blue Stimulus Packages Announced by Selected Countries

COUNTRY	SELECTED BLUE STIMULUS PACKAGES
<b>Australia</b>	At a sub-national government level, the Victoria government package includes A\$129 million for the Department of the Environment, for upgrading public land facilities, supporting solar and water infrastructure and addressing erosion and flood risk in marine and coastal areas (Victoria State Government 2020). The Queensland government has committed to provide A\$17 million to create a renewable energy training facility as well as a A\$8.93 million boost to national parks (including key coastal and marine parks), to provide visitor infrastructure upgrades and enhancements to reenergise nature-based tourism (Queensland Government 2020).
<b>Canada</b>	New assistance amounting to US\$62.5 million will be provided to the fish and seafood processing sector through the Canadian Seafood Stabilization Fund, and US\$75 million is set aside for emissions reduction in offshore oil and gas. Funding of US\$469.4 million will be used to establish the new Fish Harvester Benefit and the new Fish Harvester Grant. The program is designed to work within the unique pay structures and seasonal nature of the fishing sector. The program is open for applications from 24 August to 21 September 2020 (Fisheries and Oceans Canada 2020).
<b>Finland</b>	<p>The supplementary budget of €5.5 billion contains a package of measures supporting the recovery and revitalisation of the economy with a sustainable focus.</p> <ul style="list-style-type: none"> <li>▪ €13.1 million for state-run rehabilitation of nature sites and the development of nature tourism.</li> <li>▪ €53 million for projects involving green areas, water services and forest conservation. Funding is also proposed for the rehabilitation of local recreation areas.</li> <li>▪ €20.75 million for innovation support for shipbuilding.</li> <li>▪ €5 million for vessel design work in a project to replace three present offshore patrol vessels with vessels capable of responding to oil and chemical spills.</li> </ul> <p>The previously agreed national climate fund will be capitalised by €300 million. The fund will focus on combatting climate change, promoting digitalisation and boosting low-carbon operations in manufacturing industries (Finnish Government 2020).</p>

21. Specific stimulus packages include, for example, bailout measures of the aviation industry without green conditionality, subsidies for fossil fuel vehicles and an easing of permits for coal mining.

**Table 2.** Examples of Blue Stimulus Packages Announced by Selected Countries, continued

COUNTRY	SELECTED BLUE STIMULUS PACKAGES
<b>European Union</b>	<p>For climate targets, the Green Deal sets aside about €225 billion (US\$190 billion) for the recovery fund and €322 billion (US\$280 billion) for the 2021–27 budget. Specific detail on the climate policies is not provided. The European Union will report annually on its climate expenditure<sup>a</sup>.</p> <p>The targets proposed by the European Commission in the Communication on the Farm to Fork strategy (Green Deal on food system) include reduction the use of fertilisers and pesticides, which cause marine pollution.</p> <p>As part of green legislation, the European Commission’s Environment Committee voted to include CO2 emissions from the maritime sector in the EU Emissions Trading System (ETS), with a new target of 40 percent CO2 reduction by 2030 (EU Parliament 2020).</p> <p>The Environment Committee also called for an ‘Ocean Fund’ for the period from 2023 to 2030, financed by revenues from auctioning allowances under the ETS, to make ships more energy efficient and to support green infrastructure.</p>
<b>Germany</b>	<p>The International Climate Initiative will spend €68 million (US\$58 million) to support 29 projects (in 25 countries) responding to COVID; building future economic, social and ecological resilience; and seeking to prevent a new pandemic. The initiative aims to expand the role of green hydrogen as a part of modernising shipping programmes and helping the sector’s transition towards decarbonisation (BMU 2020). Its mission is to invest in a sustainable recovery of the economy (including increasing climate resilience of the fishing sector) to contribute to climate change mitigation and the conservation of biodiversity (IKI 2020).</p>
<b>Italy</b>	<p>A state aid scheme worth €100 million (US\$85 million) will support agriculture, fishing and aquaculture small and medium enterprises. The fund will provide aid to maintain their activities through state guarantees on investment and working capital loans and direct grants to provide support during the temporary cessation of fishing activities (EU Commission 2020b).</p>
<b>India</b>	<p>Rs 20,050 crore (US\$2.7 billion) will be invested over the next five years to bring about a blue revolution through sustainable and responsible development of the fisheries sector.</p>
<b>Jamaica</b>	<p>Grants totalling US\$1.2 billion will be made available to businesses operating in the tourism and related sectors (KPMG 2020).</p>
<b>New Zealand</b>	<p>An NZ\$1.1 billion (US\$736 million) environmental jobs program will aim to create 11,000 jobs, include major investments in restoring wetlands.</p>
<b>Norway</b>	<p>NOK3.6 billion (US\$400 million) is budgeted to support green technology projects that would benefit offshore wind and low-emissions shipping (Nikel 2020). A ‘green transition package’ (US\$384.5m) will be used to support a range of initiatives, including investments in hydrogen power and battery storage technology and building offshore wind infrastructure as Norway looks to reach the Paris Agreement target of limiting global temperature rise to less than 2 degrees Celsius by 2050 (Casey 2020).</p>
<b>United States</b>	<p>Section 12005 of the Coronavirus Aid, Relief and Economic Security (CARES) Act allocates US\$300 million in fisheries assistance funding to states, tribes and territories with coastal and marine fishery participants who have been negatively affected by COVID-19 (NOAA 2020).</p>
<b>Vietnam</b>	<p>An extension is proposed for wind energy projects (including offshore wind) until 31 December 2023 (more than two years beyond the current deadline of 1 November 2021), and a new solar power feed-in tariff (including floating solar energy projects) has been announced (Morris 2020).</p>

Notes: The list of stimulus packages with a focus of blue sustainability is not exhaustive. Exchange rates: €1 = US\$1.1842; NZ\$1 = US\$0.67; Rs1 = US\$1.013; NOK1 = US\$0.11.

<sup>a</sup> The Green Deal consists of a €750 billion recovery fund and a €1.074 trillion EU budget for 2021–27. The amount of money set aside for climate targets, is set at 30 percent. The recovery fund alone would be the largest green stimulus in history. Specific detail on the climate policies is not provided, and the European Union will report annually on its climate expenditure.

## DEVELOPMENT BANKS AND BILATERAL DEVELOPMENT AID

During the crisis, domestic resource mobilisation has decreased in low-income countries, and external private finance is projected to drop by US\$700 billion in 2020, with significant capital flight as a compounding problem (OECD 2020d). Remittances are predicted to fall by 20 percent in 2020 (Ratha et al. 2020), and foreign direct investment is expected to decline 30–40 percent in 2020–21 (UNCTAD 2020a). Given the uncertainty of domestic finance opportunities in many low- and middle-income countries and the volatility of private flows, the need for bilateral and multilateral finance is unparalleled.

A number of multilateral development banks and international financial institutions have mobilised resources to counteract the economic crisis in the most vulnerable countries. For example, the International Monetary Fund (IMF), World Bank, Asian Development Bank and other regional partners are working together on approaches to assist countries in the Pacific overcome the challenges of the current crisis and position themselves for economic recovery (IMF 2020c)<sup>22</sup>. A number of SIDS would also be eligible to apply for short-term debt relief as a part of the IMF's Catastrophe Containment and Relief Trust (Coke-Hamilton 2020). As a part of building back better after COVID-19, the Asian Development Bank is working in cooperation with the UN Economic and Social Commission for Asia and the Pacific (ESCAP) on areas including gender inequality, climate change and ocean pollution (ANI 2020). Additionally, the African Development Bank (2020) has approved €225 million for a budget support loan for Egypt's electricity sector to bolster economic resilience and sustainability. These financial support measures would be in addition

to several blue finance initiatives that were set up before the pandemic to achieve sustainable ocean health and governance. This includes the Asian Development Bank's (2019) commitment of US\$5 billion (2019–24) to expand its investments and technical assistance in ocean health and the blue economy; the World Bank's PROBLUE initiative that focuses on four pillars (fisheries and aquaculture; marine pollution; oceanic sectors and seascape management)<sup>23</sup>; and the European Investment Bank's commitment to more than double its lending to sustainable ocean projects, to €2.5 billion (\$2.7 billion), over the next five years (Richens and Koehring 2020)<sup>24</sup>. However, blue measures still constitute a very small share of the response budget for development banks, and the role that blue recovery measures can play in responding to the crisis could more explicitly emphasized.

Bilateral aid and official lending to low- and middle-income countries from other countries can also make a big difference for the recovery. G20 nations have agreed to freeze bilateral government loan repayments for low-income countries until the end of the year as part of a plan to tackle the health and economic crises triggered by the pandemic and prevent a debt crunch in emerging markets<sup>25</sup> (Wheatley et al. 2020). New Zealand has pledged NZ\$55 million in aid spending for Pacific island nations (Dreaver 2020). Similarly, Germany, through the International Climate Initiative, has invested in a number of sustainability projects in 25 countries in response to COVID-19 to build future economic, social and ecological resilience (IKI 2020). Overseas development assistance (ODA) has also played a key role by building health and social protection systems in developing countries, which are critical to countries' ability to respond to the

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22. The doubling of the IMF's emergency financing capacity means that up to \$643 million could be made available immediately to the Pacific island economies.

23. In fiscal 2019, PROBLUE received signed contributions of over US\$50 million from five donor countries (development partners are in the process of signing for over \$100 million). Actual funds received from donors totalled approximately \$28.8 million. Because of the focus on operationalising the trust fund and preparing the February 2019 annual work plan, PROBLUE approved grants of \$2 million, of which \$600,000 were disbursed, as of fiscal year 2019. Grant amounts and disbursements are expected to accelerate significantly in fiscal year 2020. As of 30 June 2019, PROBLUE's total fund balance, taking into account actual funds received from donors, disbursements, commitments, and investment income, was just over \$28 million.

24. The bank expects to mobilise at least €5 billion in investments from private-sector companies and investors, among other partners (Richens and Koehring 2020).

25. The moratorium on bilateral government debt repayments will begin on 1 May 2020. It will apply to the 76 countries that are eligible to receive assistance from the World Bank's International Development Association, which works with the poorest countries, as well as all nations defined as least developed countries by the United Nations. Eligible countries must be 'current' on any debt service payments to the IMF and the World Bank.

COVID-19 crisis and are central to resilience and recovery (OECD 2020d). However, with several countries' budgets in turmoil, it is possible that the overall level of ODA could decline in 2020 (OECD 2020e)<sup>26</sup>. In addition, recent analysis by OECD shows that over the 2013-18 period a mere 0.8% of global ODA was allocated to support sustainable ocean economy and highly concentrated in three sectors—maritime transport, fisheries and marine protection (OECD 2020f). This suggests that more could be done to support a wider range of existing and new ocean-based sectors and thus foster greater economic diversification and resilience post pandemic (OECD 2020f).

### INTERNATIONAL ORGANISATIONS AND NON-GOVERNMENTAL ORGANISATIONS

The role of IOs and NGOs is vital in supporting local and national efforts to fight the pandemic. IOs are helping client countries to better address the impacts of this crisis, with a focus on empowering, protecting and prioritising the most vulnerable<sup>27</sup>. For example, the COVID-19 response offer of the UN Development Programme (UNDP) focuses on SIDS and aims to support long-term recovery efforts in these regions by helping them diversify (and sustainably expand ocean economy activities) as well as digitally transform to respond rapidly to crises<sup>28</sup>.

Many IOs are working directly with industry associations to address the pandemic's short-term and long-term impacts on specific sectors. For example, industry groups, such as the International Chamber of Shipping and the International Association of Ports and Harbours, and UN organisations like the World Health Organization, the International Labour Organization and the International Maritime Organization, have already led an enormous effort to establish safety protocols for preventing and mitigating COVID-19 in vessels and ports, and have also come together to explore ways to safely facilitate crew changes from disembarkation to the airport (Henriksen and Selwyn 2020). The International Chamber of Shipping has led the creation of a 12-step plan for governments on how to undertake

crew changes<sup>29</sup>. The UN Global Compact is calling for a coalition of willing governments to protect global ocean supply chains by classifying these workers as 'essential'; this includes offshore energy workers and fish farmers as well as seafarers (UNGC 2020a). The UN secretary general has called for bailouts of the shipping industry to be conditioned on alignment with the goals of the Paris Agreement (Chambers 2020b).

NGOs are working in partnership with multinational development banks and other financial institutions to address immediate needs whilst supporting a resilient, equitable and sustainable ocean economy. For example, the World Wildlife Fund is working to ensure continued monitoring and effective management of marine protected areas from the impacts of IUU fishing and other activities; advocating stimulus measures that promote clean energy and sustainable development; and making guidance available to cities dealing with high amounts of medical plastic waste (Plastic Cities 2020). Some NGOs are working with local fishers and women fish workers to connect catch to private households or local markets (e.g. restaurants), thereby supporting direct marketing of catches that would otherwise go unsold. For example, Rare is working with a fishing community in the Philippines to help manage its long-term finances (by setting up savings clubs), providing transportation for fishers (through engagement with government) and raising awareness about enforcing fish sanctuaries important for the long-term sustainability of community livelihoods (Polo 2020).

### PRIVATE INVESTMENT

Some private sector companies are exerting pressure on governments to ensure that COVID-19 recovery is green and harnesses science-based targets. For instance, in May, a climate advocacy effort, backed by the United Nations and led by chief executive officers, saw 150 global corporations urge a net-zero recovery (UNGC 2020). Private sector companies are also actively engaging in UN task forces to help with the global COVID-19 response<sup>30</sup>.

26. The OECD calculates that if Development Assistance Committee members were to keep the same ODA to gross national income ratios as in 2019, total ODA could decline by \$11 billion to \$14 billion, depending on a single- or double-hit recession scenario on member countries' GDP.

27. For more detail, see the UN COVID-19 response information at <https://www.un.org/en/coronavirus/information-un-system>.

28. The approach is to diversify and expand ocean economy activities and digital transformation to bolster governments' institutional capacities to respond rapidly to crises.

29. A 'roadmap' was developed by a 'supply chain coalition led by industry and unions in cooperation with UN agencies' (ICS 2020c).

30. For instance, cross-sectoral ocean companies are actively participating in the UN Global Compact Task Force, with aquaculture players such as Cermaq and Bakkafrøst, maritime insurers such as Gard AS and maritime classification companies including Lloyd's Register and DNV GL.



Blended social and green finance has also grown due to mounting pressure on business to implement more sustainable business practices (Laidlaw 2020)<sup>31</sup>. Also, evidence that green/SDG funds are outperforming their peers during COVID-19 could make investment in ocean-related projects more attractive (Corporate Citizenship 2020). Banks and investors are also under pressure from stakeholders to allocate more funding for environment, social and governance (ESG) initiatives, and some investment firms have launched clean energy funds. For example, the Southeast Asia Clean Energy Facility (SEACEF) is providing early-stage venture capital-type funding to get new clean energy projects off the ground in Southeast Asia (Nguyen 2020)<sup>32</sup>. However, there is some risk that ocean-based start-ups will face dwindling funds as private institutional investors have frozen their investment decisions (Runyon 2020). Lack of financing will likely cause some start-ups to stop their activity.

## 2.2 Gap between Impacts and Response

An assessment of responses to COVID-19 from governments, the private sector, development banks and the 'third' (or voluntary) sector show that a limited number of investments are directed towards the ocean economy, and a small subset focuses on transitioning to a sustainable ocean economy. Within the blue measures there has been more of a focus on short-term coping strategies to address the immediate impacts of the crisis, such as high unemployment, business insolvency and health risks faced by ocean economy workers. Shifting this focus to the development and implementation of longer-term resilience-building strategies will be key to preventing future shocks and responding to ongoing

stressors, such as climate change and biodiversity loss. It is imperative that ocean activities and industries transition towards smarter, sustainable practices that conserve marine ecosystems and promote human well-being both now and into the future.

Based on an assessment of the gap between impacts and responses, we summarise below the consequent missing action or unintended impact on local economies and the health of the ocean.

**To protect the livelihood of small-scale fisheries in the long term, it will be important to ensure that support policies from national governments do not encourage overfishing practices or IUU fishing that damage ocean ecosystems and deplete stocks.** A

number of measures have been introduced to promote the recovery of the sector and support the fishers (especially vulnerable groups) facing loss of livelihoods due to the crisis. However, while license fee waivers, measures to reduce input costs (through provision of loans at subsidised interest rates), deferrals and rollover of unused fishing quota are being used to support fishers by reducing fishing costs, this could lead to an environmental trade-off by incentivising overfishing<sup>33</sup>. Measures such as decommissioning schemes or payments for early retirement (e.g. the European Maritime and Fisheries Fund's allowing EU member states to pay fishers and aquaculture producers for a reduction or cessation in production) could reduce oversupply of fleets. However, whether such steps lead to longer-term reductions in fishing pressure and ultimately to healthier fish stocks will depend on whether they postpone fishing effort (OECD 2020d). Measures that incentivise sectors to move towards the sustainable

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31. There has been gravitation towards a more blended sustainable approach and with considerations of environmental, social and governance factors. Social bond issuance for 2020 totalled US\$11.58 billion as of 15 May, compared to just \$6.24 billion in the same period of 2019, according to an International Capital Market Association analysis of the Environmental Finance database. Demand for sustainability bonds, something of a hybrid between green and social bonds, has also surged. It reached \$25.62 billion in the year through 15 May, compared to \$13.64 billion in the same period a year earlier. Green bond issuance, in contrast, has dropped sharply. It totalled \$53.54 billion in 2020 as of 15 May, compared with \$84.09 billion in the same period of 2019.

32. The fund is supported by international climate foundations including Sea Change Foundation International, the Wellspring Climate Initiative, the High Tide Foundation, the Grantham Foundation, Bloomberg Philanthropies, the Packard Foundation and the Children's Investment Fund Foundation. The supporting global philanthropies have invested an initial \$10 million in SEACEF, and are seeking to attract up to \$40 million in additional capital. It is expected that every dollar of high-risk venture capital-type funding deployed by SEACEF will leverage up to 50 times more in follow-on investment in the clean energy portfolio across Southeast Asia—reaching more than \$2.5 billion in assets—while cultivating the local ecosystem of developers to grow the market. The initial focus will be on Vietnam, the Philippines and Indonesia.

33. Input cost-reduction measures (such as the provision of fuel subsidies) tend to benefit larger fleets at the expense of small-scale fisheries.

Recovery following the crisis presents an opportunity to think about innovative measures where tourism businesses play an active role in uplifting local communities and protecting coastal and marine environments

management of fish stocks will be key for economic recovery and equitable prosperity in the long term. It will be important to ensure that support policies and investments do not encourage overfishing practices or IUU fishing that damage ocean ecosystems and compromise the sustainability of resources, putting future resilience at risk.

**To help reduce seafood waste and meet long-term food security targets, continuity of investments facilitating the growth of sustainable mariculture will be key.** Measures aimed at improving storage of mariculture and fisheries

products will also deliver environmental benefits, reducing loss and waste of fish products across the supply chain. Growth of sustainable mariculture practices will be very important for food security, and investments in sustainable mariculture will require a substantial mobilisation of capital. A number of innovative practices are being developed in the sector to support its sustainable transition (including aquafeed alternatives, industrialisation of seaweed and bivalve farming). While some of these have been driven by private investments, financing from public bodies (such as the development banks and national governments) can help mobilise private capital by building confidence and reducing risk.

**To help make up for declining tourism-based funding for ocean conservation, there is an immediate need for interventions that help protect vital and vulnerable marine ecosystems.** While decreased

tourism funding has led to an increase in alternative methods of funding for marine conservation (such as crowdfunding and donations from private foundations), these funding mechanisms are unlikely to be sustained. In addition, some marine sanctuaries have been opened to fishing, which can quickly erase the progress made on marine biodiversity recovery in these sites. The current protected area network is only receiving about one-third of the funding it needs to be effectively implemented and managed, and the shortfall is even greater in developing countries (Waldron et al. 2020). Expanding protection to at least 30 percent of the world's land and ocean and effectively managing it would require an average investment of US\$140 billion annually and deliver a range of benefits to society that will outweigh the costs (Waldron et al. 2020)<sup>34</sup>.

**For the long-term resilience of the coastal tourism sector and protection against future climate change shocks, investment must go into restoring and protecting marine environments and uplifting local communities.** Most emergency and recovery measures have aimed to provide income continuity for tourism workers and business continuity for small enterprises that otherwise would be unable to survive the crisis. The international community has also mobilised funds through multilateral development banks to counteract the economic crisis in the most vulnerable countries. However, much more needs to be done to stimulate demand and ensure the sector's long-term resilience once containment measures are lifted. Recovery following the crisis presents an opportunity to think about innovative measures where tourism businesses play an active role in uplifting local communities and protecting coastal and marine environments. Policies and investments supporting structural transformation are needed to help build a low-carbon, less polluting, more sustainable and resilient coastal tourism economy. In addition, targeting recovery at diversification across a range of ocean activities to reduce dependency on the tourism sector will be key to building future resilience in Caribbean and Pacific islands.

34. Waldron et al. (2020) state that this funding should come from a range of sources, including official development assistance, governments' domestic budgets, climate financing directed to nature-based solutions, philanthropies, corporations and new sources of revenue or savings through regulatory and subsidy changes.

**To ensure the long-term viability of the marine transport sector, investment and regulation needs to create the right market incentives for a sustainable transition to zero-emission vessels.**

While the pandemic has curtailed the shipping sector's capacity to invest in more environmentally friendly technologies, industry is still leading a strong drive towards decarbonisation (NSA 2020b; Mærsk 2020; CMA CGM 2020). There is an important role for international organisations and governments to help keep the momentum by developing national and market incentives for decarbonising domestic and international transportation. This includes investment in green technologies, developing policy to enable the business case for the adoption by shipping of low- and zero-carbon fuels (e.g. a carbon price), develop national incentives for decarbonising domestic transportation and facilitating decarbonisation of national energy systems faster or as fast as the transition in the international fleet (Hoegh-Guldberg et al. 2019). Low-carbon domestic shipping and coastal marine transport can play a strong role in building coastal resilience. Shifting freight transport from road to waterways in emerging markets (like Africa, India or Latin America), where trucks alone are responsible for about 40 percent of transport emissions, can substantially reduce emissions and logistics costs (World Bank 2020b). Similarly, after the crisis key global partnerships will need to continue to support SIDS and least developed countries (LDCs) that face significant domestic or regional shipping decarbonisation challenges. Flexible port regulations based on screening and discretion will be needed to ensure the continuity of freight distribution and ferrying of food and essential goods so that supply chains are not hit by both low demand and supply bottlenecks (Heiland and Ulltveit-Moe 2020).

**To accelerate deployment of ocean-based energy systems, a stable economic and regulatory environment will be needed to help stimulate investments in these growing sectors.**

The vast majority of the COVID-19 relief from governments so far supports carbon-intensive industries without requiring improvements. For long-term sustainability it will be important to shift towards a green-blue recovery, where government, businesses and investors can play a role in boosting clean investment, both by promoting low-carbon supply chains and by grasping the opportunities of clean energy markets (Mojarro 2020). Governments will need to play a key role in providing a stable economic and regulatory environment to help stimulate investments required for an accelerated deployment of ocean-based energy systems. Investment will also be needed to advance ocean renewable technologies beyond offshore wind to make them more economically attractive.







### 3. Roadmap for a Sustainable and Equitable Blue Recovery

Recovery and stimulus packages represent a unique opportunity to accelerate the shift to a sustainable ocean economy that delivers on global targets under the 2030 Agenda for Sustainable Development and the Paris Agreement. Mutually beneficial, no-regrets opportunities are ready to be implemented now to support affected communities and regions, while delivering significant social and environmental benefits. These opportunities respond to the immediate need for job creation in the short-term and offer opportunities for long-term economic growth and resilience. Governments can also utilise innovative financial mechanisms to incentivise progress and avoid rollbacks in progress.



The investments that governments and financial institutions make over the coming months and years will have long-term effects on the nature of economies and their resilience to future shocks. Efforts should be made now to avoid locking in high-emitting, high-polluting and inequitable pathways that limit the ability to build sustainable and resilient economic systems. Investment through recovery and stimulus packages represents a crucial lever for accelerating the shift from business as usual to a more sustainable future that delivers on global targets under the 2030 Agenda for Sustainable Development and the Paris Agreement.

The ocean economy can play a vital role in this transition, and in turn this transition will be critical to securing a sustainable ocean economy for the future. Using recovery and stimulus packages to invest in, and introduce, both short-term and longer-term policy reform for a sustainable ocean economy can provide short-term economic relief and recovery while delivering long-term societal benefits and building economic resilience to future shocks.

This report proposes that coastal and island nations have the opportunity to pursue a ‘sustainable and equitable blue recovery’. We consider a ‘sustainable and equitable blue recovery’ to be one that advances a sustainable ocean economy predicated on three mutually reinforcing elements: effective protection of ocean ecosystems, sustainable production and equitable prosperity. A sustainable ocean economy should enable the growing global population to continue enjoying the innumerable benefits that the ocean provides.

To achieve this, it is imperative that ocean activities and industries transition towards smarter, sustainable practices that conserve marine ecosystems and promote human well-being both now and into the future.

This section of the report aims to provide a roadmap for a ‘sustainable and equitable blue recovery’ from the COVID-19 crisis.

First, it proposes a set of high-level guiding principles that act as a first step for ensuring a ‘sustainable and equitable blue recovery’. These may be helpful for governments in their initial stages of planning on how to think about the nature of their recovery after COVID-19.

Second, it proposes a set of five priority opportunities that are ripe for immediate government investment through recovery and stimulus packages, what we call ‘**blue stimulus**’ (Section 3.2). For each of these opportunities, we outline the economic (short- and long-term), social and environmental benefits to be gained from investment in this opportunity and then detail a set of potential interventions for governments based on their national circumstances. We identified these five priority opportunities based on a set of guiding principles outlined in Section 3.1.

Third, it proposes a set of additional opportunities that are more systemic in nature and oriented towards using this moment as a reset for the ocean economy to build long-term economic resilience to future shocks, what we call ‘**blue transformations**’ (Section 3.3 and Annex A). Not all these options necessarily provide the short-term economic benefits that the five priority opportunities do, but they are equally important for securing economic recovery, resilience and prosperity over the longer term. Governments that have the capacity to introduce more systemic and long-term policy reform at this time (in addition to taking action on the five priority areas) will find this longer list of additional interventions helpful.

Fourth, it looks at the potential role of financial grants and debt relief as an unprecedented opportunity to advance key reforms in areas such as sustainable fisheries management, monitoring and enforcement of protected areas and ocean data, what we call ‘**blue conditionality**’ (Section 3.4).

The proposed opportunities and interventions outlined in this section are not intended to be exhaustive; they do not include everything that will be required to fully transition to a sustainable ocean economy. Resources aimed at providing the full suite of necessary interventions are contained in Annex B. This report focuses on identifying the interventions most relevant at this unique point in time—recognising financial and capacity limitations that many countries have and the urgency of ensuring economic opportunities and health outcomes for their communities over the next few years as we recover from the COVID-19 crisis.

Each country will need to carefully evaluate the full set of interventions against its national priorities, circumstances, impacts and geography to ensure that the options pursued deliver the greatest benefit for its population.

### 3.1 Proposed Principles for a Sustainable and Equitable Blue Recovery

Given the gap between the impacts experienced by workers and sectors in the ocean economy and the early responses from governments and other stakeholders in their stimulus packages, decision-makers will need to better consider how to integrate the ocean and ocean economy into recovery measures.

This report proposes three high-level guiding principles<sup>35</sup>:

1. Actively advance (through direct investment or policy) projects and programs that contribute to building a long-term sustainable and equitable ocean economy.
2. Identify opportunities to make public finance and debt relief conditional on advancing core national priorities for a sustainable and equitable ocean economy.
3. Assess the impact of all interventions across sectors on the health of the ocean and ocean economy and either avoid investments that will detract from this long-term goal (e.g. high-emitting, polluting terrestrial and marine industries or inequitable practices) or minimise their impact through additional conditions or requirements.

Sections 3.2, 3.3 and 3.4 of this report provide a set of priorities for putting principles 1 and 2 into action.

The Sustainable Blue Economy Finance Principles provide a framework for implementing principle 3 (WWF 2018). These are voluntary principles that act as a framework to guide investment and development decisions. These principles complement existing frameworks in sustainable finance and recognise the importance of compliance, transparency and disclosure, as well as the specific challenges of investment in the

context of the ocean. They are designed to support the Sustainable Development Goals (SDGs), in particular Goal 14 ('Conserve and sustainably use the oceans, seas and marine resources for sustainable development'). They are also designed to comply with the International Finance Corporation's Performance Standards and the European Investment Bank's Environmental and Social Principles and Standards (WWF 2018).

### 3.2 Five Priority Opportunities for a Blue Stimulus

Given the need for governments to respond to the immediate economic impacts experienced by most countries and coastal communities and the short-term priority of job creation and income protection, we can identify five priority opportunities ripe for immediate intervention by governments through recovery and stimulus efforts. These opportunities not only offer significant short-term job creation and income protection potential for affected communities but also offer long-term economic benefits in the form of catalysing sustainable ocean industries for the future and increasing resilience.

We identified these five priority opportunities through a literature review and expert input from government representatives involved in the design of recovery and stimulus packages and bilateral and multilateral funders (Figure 3). We sought opportunities that provided the following:

- Short-term job creation (considering a match between the skills needed and those available in the local workforce) in the ocean sectors and communities affected by COVID-19 (European Commission 2020b)
- Ability to build long-term resilience to future shocks (considering improving human, natural and physical capital) (Hammer and Hallegatte 2020; OECD 2020e)
- Ability to directly respond to impacts suffered (e.g. economic, social or environmental) and support economic recovery in more than one sector

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35. See also the UNGC Sustainable Ocean Principles for the private sector. They propose nine principles that cover three areas: ocean health and productivity; governance and engagement; and data and transparency (UNGC 2019).

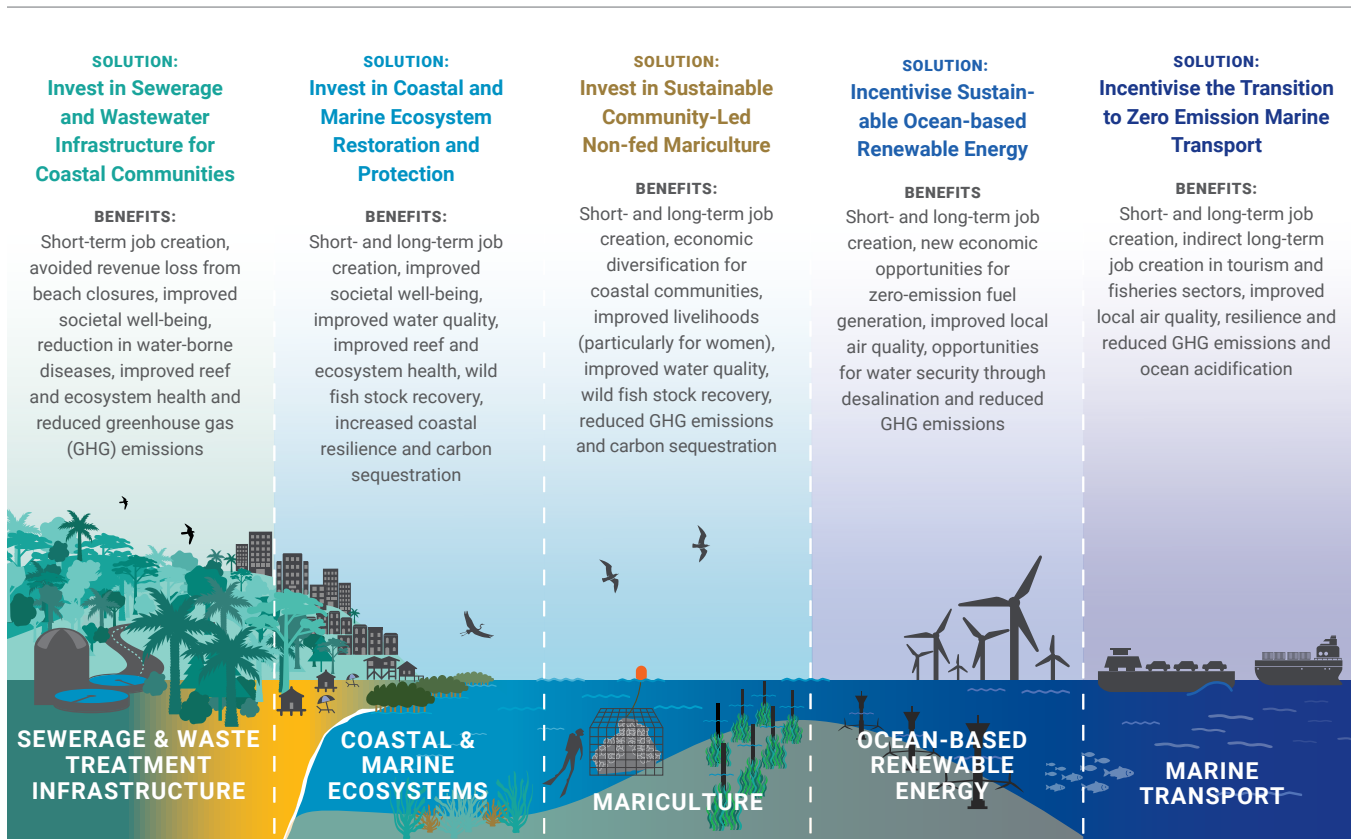
- Ability to direct economic benefits to affected communities and vulnerable members of society (a people-centred approach) (UN 2020b)<sup>36</sup>
- Speed and feasibility of implementation (considering supply chain blockages and capacity of local communities) (Hepburn et al. 2020)<sup>37</sup>
- Ability to catalyse progress towards a long-term sustainable and equitable blue economy (Hepburn et al. 2020)
- Ability to deliver on international commitments such as the 2030 Agenda for Sustainable Development and the Paris Agreement (IMF 2020b)

- Relevance to multiple regions and economies (OECD 2020e)

In advancing a ‘sustainable and equitable blue recovery’ it will be important to make decisions in accordance with integrated and holistic long-term plans and strategies, so that investments are made in alignment with national priorities.

Such planning tools include integrated ocean management, integrated coastal zone management and marine spatial planning (MSP). Establishing MSP processes in addition to integrated ocean management will be essential to deal with the inherent variability

**Figure 3.** Five Priorities for Ensuring a Sustainable and Equitable Blue Recovery to the COVID-19 Crisis



36. The UN secretary general has stressed the need to ensure that national and local response and recovery plans identify and put in place targeted measures to address the disproportionate impact of the virus on certain groups and individuals, including migrants, displaced persons and refugees, people living in poverty, those without access to water and sanitation or adequate housing, people with disabilities, women, older people, LGBTI people, children and people in detention or institutions.

37. Factors relevant to the design of economic recovery packages include the long-run economic multiplier, contributions to the productive asset base and national wealth, speed of implementation, affordability, simplicity, impact on inequality and various political considerations (Hepburn et al. 2020).

of the ocean and a dynamic future shaped by climate change. Cohesive planning can facilitate optimal use and benefit from ocean resources by all users while streamlining management to improve governance and conservation of critical habitats<sup>38</sup>. Ideally, countries should develop a sustainable ocean economy plan that acts as a comprehensive strategy for advancing effective protection of ocean ecosystems, sustainable production and equitable prosperity.

## One: Invest in Coastal and Marine Ecosystem Restoration and Protection

Coastal and marine ecosystem restoration can broadly be defined as activities that are aimed at moving these ecosystems (mangroves, salt marshes, seagrasses, kelp and seaweed forests and reefs) to healthier states, often with the goal of increasing their ability to provide ecosystem services. This includes replanting coastal mangrove forests that have been degraded, reconstructing saltmarshes that have been lost to human development and enhancing the structural complexity of damaged reefs (both coral and shellfish). The potential benefits of restoration projects are higher—often significantly higher—than the costs, making such projects prime candidates for investment as part of recovery and stimulus packages (Bayraktarov et al. 2015).

Analysis indicates a potential net benefit of US\$97 billion to \$150 billion for mangrove restoration and \$48 billion to \$96 billion for mangrove conservation over 30 years (2020–50)<sup>39</sup>. This results in a benefit-cost ratio of 3:1 for both mangrove conservation and restoration (Konar and Ding 2020)<sup>40</sup>.

Restoration of coastal and marine ecosystems has been identified as a priority due to its potential for job creation in the short term and significant potential in terms of

avoided greenhouse gas (GHG) emissions. It is also a necessary precondition for protection and subsequent management and conservation efforts. Ensuring that ecosystems are placed under full or high protection and effective management is a critical element of a sustainable ocean economy and opportunities for countries to use debt for nature swaps as a means of expanding their marine areas under protection (see Box 7 below).



SUPPORTING RECOVERY AND RESILIENCE IN THESE SECTORS:  
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SUPPORTING ACHIEVEMENT OF THESE SDGs:

### WHY INVESTMENT MAKES SENSE

**Restoration of coastal and marine ecosystems provides short-term job creation in a number of industries at the local and regional level.** Restoration works create jobs immediately through construction. Restoration projects extend to the full set of economic activities that contribute to restoration, from project

38. The value of such planning instruments at times of economic hardship is illustrated by an MSP process in Massachusetts that led to a proposed optimum arrangement with associated value, calculated at preventing more than \$1 million in losses to the incumbent fishery and whale-watching sectors and generating more than \$10 billion in extra value to the energy sector (White et al. 2012).

39. The total value of net benefits for mangrove restoration over 30 years is higher than for conservation because we assume the area of mangroves restored is 10 times that of the area conserved. The conservation scenario assumes stopping the additional loss of mangroves, whereas the restoration scenario assumes replanting large areas of mangroves already lost; that is why we are doing more restoration in the scenarios analysed than conservation. The overall ratio of both conservation and restoration is calculated by adding the total present value benefits and costs of both measures. The very high restoration costs are the main factor driving the overall benefit-cost ratio for both conservation and restoration.

40. Konar and Ding's (2020) study estimates the benefit-cost ratio for mangrove conservation to be higher (88:1) than restoration (2:1) due to a number of factors: the higher cost of mangrove restoration (due to seeding and replanting), the low survival rates following restoration and the lag in accrual of benefits from restoration.

planning, engineering and legal services, to intermediate suppliers of inputs, to on-the-ground earth-moving, forestry and landscaping firms that contribute to the ecological restoration process (BenDor et al. 2015). Restoration can include a full spectrum of jobs from all skill levels and technical backgrounds, including general trades, barge drivers, engineers, transportation, scientists and hatchery staff, oyster farmers and

hydrologists. The economic benefits derived from coastal and marine restoration projects are not limited to direct jobs. However, much of the economic benefit is in uplift to the service and beneficiary industries associated with increased coastal productivity, including fishing, tourism, wastewater treatment and marine equipment and boat suppliers (Appeaning Addo et al. forthcoming)<sup>41</sup>. Other estimates for coastal and marine restoration works in the

## Box 5. Coastal Restoration in the United States

Following the 2008–9 global financial crisis and expenditure under the American Recovery and Reinvestment Act (ARRA) of 2009, the National Oceanic and Atmospheric Administration (NOAA) estimated that coastal habitat restoration projects created, on average, 17 jobs per million dollars spent<sup>a</sup>. This is similar to other conservation industries such as parks and land conservation, but much higher than other traditional industries, including coal, gas and nuclear energy generation.

The study shows that the 50 ARRA projects administered by NOAA in the first year and half generated a total of 1,409 jobs (Edwards et al. 2013). Many of these jobs were created in rural and regional coastal areas and offer a range of skilled and low-skilled positions, considerably enhancing economic opportunities in regional areas. Jobs were created for day

labourers, administrative staff, barge operators, lawyers, accountants, engineers, helicopter pilots, fisherman, scientists, nursery workers and project managers. Longer-term employment can be created through the flow on benefits (uplift) created by an increase in productivity of coastal ecosystems and generation of wider ecosystem services benefits (for example, increased employment from improved productivity and higher tourism opportunities).

The median (global) restoration cost for all coastal ecosystems (mangroves, saltmarshes, seagrasses, coral reefs and oyster reefs) was estimated to be around \$80,000 per hectare (Bayraktarov et al. 2015). Costs for restoration vary considerably within and between ecosystems and across countries (Bayraktarov et al. 2015)<sup>b</sup>.

<sup>a</sup> The model used to calculate these job numbers was the economic input/output software called IMPLAN (Impact Analyses and Planning) to estimate overall jobs and economic impacts. The economic data for IMPLAN come from the system of national accounts for the United States based on data collected by the U.S. Department of Commerce, the U.S. Bureau of Labor Statistics and other federal and state government agencies. Data are collected for 528 distinct producing industry sectors of the national economy corresponding to the Standard Industrial Categories. Industry sectors are classified on the basis of the primary commodity or service produced. Corresponding data sets are also produced for each county in the United States, allowing analyses at the county level and for geographic aggregations such as clusters of contiguous counties, individual states or groups of states.

<sup>b</sup> The median restoration cost per hectare for mangroves, seagrasses, oyster reefs, coral reefs and saltmarshes is estimated to be \$8,961, \$106,782, \$165,607 and \$67,128, respectively. Total project costs—calculated for projects that included both capital and operating costs—for restoring seagrass, saltmarshes and oyster reefs were two to four times higher than the median.

41. Estimates are based on Oregon's restoration project, and labour intensity will depend on local factors. The model used the economic impact modelling software IMPLAN 3.0 to describe the impacts from public investments in forest and watershed restoration. It was based on an input-output analysis to describe the patterns of trade and the degree to which goods and services are sold and purchased outside the state's economy. Based on the dependencies among different economic activities, input-output models can project the impact that changes in one sector will have on economic activity in other sectors of the economy.



United States ranged from 15 to 33 jobs per \$1 million, depending on the type of activity (removal of invasive species from coral reefs generated the most jobs), but the majority of projects fall within a range from 15 to 19 jobs per \$1 million of expenditure (Edwards et al. 2013) (see Box 5 for more details). By comparison, investment of \$1 million in traditional energy-intensive industries have been estimated at 14.4 jobs for road and bridge developments, 6.8 jobs for coal mining, 4.2 in nuclear and 5.2 jobs in oil and gas and 8.9 for offshore oil and gas (Hurowitz 2020; Pollin et al. 2009)<sup>42</sup>. These jobs can be created in rural areas, where poverty tends to be concentrated in low- and middle-income countries.

**Healthy coastal and marine ecosystems under full or high protection and effective management can deliver long-term job creation and economic growth potential in ecotourism and artisanal fisheries.** The protection and effective management of coastal and marine ecosystems through fully or highly marine protected areas (MPAs) (Carrasquilla Henao and Juanes 2017) or other effective conservation-based measures (OECMs) can deliver long-term economic opportunities for coastal communities. Analysis has shown a benefit-cost ratio of between 3:1 and 20:1 of expanding the MPA network, meaning that every \$1 invested returns up to \$20 in benefits (WWF 2015). Analysis shows that expanding protected areas to cover 30 percent of the planet (terrestrial and ocean) would generate higher overall output (revenues) than non-expansion (an extra \$64 billion to \$454 billion per year by 2050). This would be in addition to economic benefits (avoided-loss value estimated to be \$170 billion to \$534 billion per year by 2050) (Waldron et al. 2020)<sup>43</sup>. In terms of direct job creation, coastal and marine ecosystems under protected area status generate demand for administration, conservation, management, monitoring, surveillance and scientific research jobs located in the local community. For example, for the Natura 2000 network (terrestrial and marine), every €1 billion of expenditure

supports almost 30,000 jobs, with 60 percent of these on activities directly related to site management (e.g. designation, management, conservation actions, monitoring and research) (Mutafoglu et al. 2017). In addition, MPAs generate demand for other services, such as technology to improve surveillance and management (see Section 3.4 on how to digitise such efforts in a post-COVID-19 world) (EU Commission 2018). The restoration and protection of these ecosystems also directly improves the potential for ecotourism or the recovery and long-term viability of the coastal tourism sector. Studies have shown that ecotourism in marine protected areas provides 4–12 times greater economic returns than the economic returns from solely utilising the area for fishing (for example, A\$5.5 billion annually and 53,800 full-time jobs in the Great Barrier Reef) (Deloitte 2017; Duarte et al. 2020). The port city of Xiamen, located on the west coast of the Taiwan Strait and one of the busiest ports in China, faced environmental degradation, sea-use conflicts and ineffective management. As a result of improving protection and advancing ecosystem restoration, the Chinese white dolphin population returned and tourist numbers increased from 5 million in 1996 to more than 100 million in 2019 (Winther et al. 2020). Industry has also been able to flourish, with year-on-year growth staying above 10 percent. New marine high-tech industries (biological pharmacy, science and education service, high-end equipment) have also grown (Winther et al. 2020). Roncin et al. (2008) summarise the impact of Southern European MPAs on local economies<sup>44</sup> and calculate the yearly local income related to services to non-resident recreational users to be €640,000/year per MPA and 15 yearly full-time equivalent jobs<sup>45</sup>. Lastly, MPAs and OECMs are critical tools to increase fisheries' productivity, maintain fish stock levels and thereby ensure ongoing economic opportunities for artisanal and commercial fisheries as well as provide local food security (Brander et al. 2015). In a meta-analysis looking at the role of biodiversity loss on ecosystem services, data showed that post-designation, levels of biodiversity

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42. Multipliers were derived using IMPLAN 2.0 with 2007 data. Infrastructure multipliers and assumptions are presented in Pollin et al. (2009). The estimates are based on input-output models. Key limitations include the assumption of fixed prices (prices do not change when demand for a good, service, or input changes), fixed ratios of labour to other factors of production and fixed sectoral share of GDP over time.

43. The financial estimates are for both terrestrial and marine protected areas. The economic estimates only refer to forests and mangroves.

44. Empirical evidence is based on surveys with fishermen and divers (1,836 questionnaires).

45. Estimates are based on local expenditures of non-resident recreational fishers and scuba divers only. Estimates would likely be higher if expenditure of all tourists were included.

of fully protected areas increased by an average of 23 percent, with large increases in fisheries' productivity in areas adjacent to the MPA (known as the spillover effect) (Halpern et al. 2010). Fisheries in medium- to high-decline gained the most from spillover from highly and fully protected MPAs (WWF 2015). Another study that looked at the combined economic benefits of MPAs found that both tourism and neighbouring fishery profits increased within as little as five years after the reserve was established (Sala et al. 2013).

**Healthy coastal and marine ecosystems deliver improved health, well-being and resilience for coastal communities.** Restoration of these ecosystems can deliver significant benefits for improved food security for coastal communities (TNC 2013)<sup>46</sup>, improved water quality (and the associated health benefits) and improved coastal recreation opportunities. Communities living in areas with more extensive mangrove forest experience significantly lower losses from exposure to cyclones than communities in coastal areas without mangroves (Hochard et al. 2019) and are more resilient to the effects of rising sea levels (Serrano et al. 2019). This is also true in communities bordering fringing reefs. Reef structures cause waves to break and reduce wave energy by an average of 97 percent, protecting the beach from possible erosion as well as reducing the number of people affected by annual flooding by more than 200,000 (Ferrario et al. 2014; Beck et al. 2018). Higher property values are associated with communities situated near restored and well-functioning coastal and marine ecosystems (Bark et al. 2009). Studies have shown that lower-income communities living in low-lying areas are the most vulnerable to natural disasters such as flood and coastal storm surges (Winsemius et al. 2018). Utilising restoration of coastal ecosystems in these areas can dramatically improve the quality of life of these communities. For example, following the 2004 floods in Bangladesh, poor households lost more than twice as much of their total income as non-poor households (Brouwer et al. 2007). Worldwide, low-income countries suffer 63 percent of all deaths

from storms, including cyclones and hurricanes, even though they experienced just 12 percent of the global total of such events (CRED 2015). Coastal and marine ecosystem restoration and protection also offer opportunities for engagement, co-ownership and co-management with Indigenous communities and traditional owners—offering knowledge-sharing and capacity building for all stakeholders involved as well as the opportunity for revenue to be reinvested back in the local community (McLeod et al. 2018). Studies have shown that engagement of local communities in long-term restoration and protection is a key success factor, and lacking it is a major reason for failure (Hai et al. 2020; Suding et al. 2015). Inclusive planning processes for restoration activities have been shown to deliver a positive social impact and equitable benefits for communities.

**Coastal and marine ecosystems also have significant carbon sequestration potential and can provide valuable mitigation opportunities in addition to improving local water quality and enhanced biodiversity.** Analysis estimates that restoration could deliver annual global emissions reductions of between 0.20 and 0.33 GtCO<sub>2</sub>e by 2050 (Hoegh-Guldberg et al. 2019), which is equivalent to taking approximately 4–7 million cars off the road annually<sup>47</sup>. The sequestration benefits from reducing CO<sub>2</sub> emissions are estimated at \$137 billion to \$214 billion for restoration over 30 years (Konar and Ding 2020). Coastal habitats are home to a number of marine and terrestrial animals (Li et al. 2018; Rog et al. 2016), including species important for fisheries (Carrasquila-Henao and Juanes 2017). These habitats buffer acidification (Kapsenberg and Cyronak 2019) and play an important role in wastewater treatment systems (Ouyang and Guo 2016). In addition, shellfish beds and reefs enhance habitat availability, benthic flora and marine organism populations. They act as nursery grounds for fish and other species (including crustacea), and their nutrients support the growth of seagrass and macroalgae (e.g. kelp) (Alleway et al. 2018; Hughes et al. 2018). Restoration of historic baselines in combination

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46. In Mobile Bay, Alabama, \$3.5 million has been spent on efforts to successfully restore 5.9 km of oyster reefs that have reduced wave height and energy of average waves at the shoreline by 53–91 percent. The reefs have also produced 6,560 kilograms of seafood per year—a weight equivalent to half the total oysters harvested in Alabama in 2015.

47. Based on the average emissions of a passenger vehicle being 4.6 metric tons per year, according to EPA (2018).

with bivalve mariculture can improve ecosystem health while providing a food source and employment (see Box 6). Bivalves are increasingly used to extract and convert pollution in the Baltic Sea (Petersen et al. 2020). In New York, the Billion Oysters Project aims to place 1 billion oysters in the harbour to help clean up its water while providing habitat for marine species, shielding shorelines from storm damage and engaging students and the local community (75 restaurants and 70 schools as of 2018) (Charlton 2019).

#### HOW THESE BENEFITS CAN BE ACHIEVED: SHORT-TERM INTERVENTIONS THAT CAN BE INITIATED NOW AS PART OF STIMULUS SPENDING AND RECOVERY MEASURES

- **Commit public funding to a set number of restoration projects.** Direct public investment to ‘shovel ready projects’ (based on a set of criteria) through stimulus funding packages. See Box 5 for the example in the United States following the 2008–9 financial crisis and Box 6 for an example of the suite of cross-sectoral benefits that can be derived from ecosystem restoration.
- **Establish national funds to mobilise private sector funding for large-scale restoration.** Initial public investment is used to attract impact investors and larger private sources of funding, including from philanthropy. The nature of the fund will need to depend on national circumstances. An example is the trust fund established for the tourist coast of Mexico’s Yucatán peninsula. A tourist tax is channelled into the fund to pay for both routine reef maintenance, such as removing debris and replanting species, and bigger repairs after hurricanes.
- **Use debt-for-nature swaps or debt restructures.** Governments could consider including restoration and/or protection of coastal and marine ecosystems under fully or highly protected MPAs or OECMs as part of debt-restructuring negotiations and debt-for-nature swaps (see Box 7 for further details on debt-for-nature swaps).
- **Incentivise use of technologies such as remote electronic monitoring, and high-resolution vessel tracking and monitoring systems and collaborative approaches with small-scale fishing fleets to enhance outcomes for marine protected areas and fisheries management.** Increasingly, market considerations are a compelling reason for small-scale fishers to adopt monitoring systems. Gaining access to export markets would improve their incomes and help develop their local economies (INFOFISH International 2020). Governments could consider incentivising the use of remote electronic monitoring (REM) in key fisheries or working on collaborative partnerships to enhance data collection in protected areas (see Section 3.4 for additional ideas on conditional grants). REM data enable cross-verification of self-reported data and can confirm vessel compliance with regulations. This approach not only discourages violations because all activities are monitored but also gives legitimacy to self-reported catch. As an example of the potential benefits, providing 10 percent video review monitoring across the over-10-metre fleet throughout the United Kingdom would cost approximately £5 million. This equates to roughly a quarter of the money spent on more traditional systems, which deliver less than 1 percent at-sea coverage (WWF 2017). Inshore vessel monitoring systems can be undertaken by using inexpensive cellular 3G/GSM/GPRS networks rather than global satellites (see, e.g., AST 2019).
- **Ensure that the definition of ‘infrastructure’ includes hybrid green-grey infrastructure.** Ensure that investments targeted at stimulating large-scale coastal infrastructure projects enable the use of hybrid green-grey infrastructure approaches (e.g. the use of nature-based solutions such as living reefs or mangroves in conjunction with traditional concrete or non-living structures). These investments can include regulatory reform, procurement and tender agreements and definitions for bilateral aid. Hybrid solutions combine conservation and restoration of coastal ecosystems with conventional engineering and can offer enhanced levels of coastal protection while also delivering the key co-benefits associated with ecosystems.

- **Invest in blue carbon projects (restoration and conservation of coastal wetlands—mangroves, seagrasses and tidal marshes) and accelerate the associated policy and regulatory reform (inclusion in national GHG inventories, nationally determined contributions and market mechanisms).** Blue carbon projects can bring sustainable carbon financing to the restoration and protection of coastal and marine ecosystems while at the same time contributing directly to a government’s international commitment under the Paris Agreement. Carbon financing is also substantially more economically stable than tourism and other income streams. Sites

must be carefully selected to meet the accounting requirements under the Paris Agreement, avoiding areas that are likely to be inundated by sea level rise. Blue carbon projects must also be advanced in conjunction with social safeguards to consider demands from local small-scale fishers and other stakeholders who are heavily dependent on coastal resources for economic sustainability (Barbesgaard 2018; Bennett 2018; Friess et al. 2019). Effective local engagement of stakeholders, ensuring their voice is heard, will be key for the success of these initiatives.

## Box 6. Restoring Shellfish Reefs in Australia and the United States

In Australia, The Nature Conservancy, in partnership with state and Commonwealth governments, has embarked upon a national program to rebuild and restore Australia’s lost shellfish reefs. Based on the results of existing pilot projects, scaling efforts to 60 reefs nationally will provide 850 new full-time jobs for local coastal communities, divert 7,000 m<sup>2</sup> of shell waste from landfills, reduce coastal erosion and deliver the following annual benefits:

- 375 kilograms of new fish stocks, including high-value snapper, flathead and whiting
- Filtration of 2 billion litres of seawater (the equivalent of the annual water use of 21,000 Australians)
- Removal of 225 kilograms of nutrient pollution (nitrogen and phosphorous) in coastal areas (TNC 2020)

In 2011, the full suite of ecosystem services derived from natural oyster reefs in North America was conservatively estimated to be between US\$5,500 and \$99,000 per hectare

per annum, with recovery of their restoration costs in 2–14 years (Grabowski et al. 2012). These services include job creation and economic development, fish production, water filtration, coastal protection and providing habitat for many other marine species. The largest current initiative is the Chesapeake Bay Executive Order, which requires the oyster populations of 20 Chesapeake Bay tributaries to be restored by 2025. Three estuaries have been restored thus far, including 964 acres of restored reef at a projected total cost of \$72.1 million<sup>a</sup>. The resulting harvested biomass has the potential to contribute millions of dollars in additional sales for commercial seafood harvesters. This would be in addition to a wide range of other ecosystem services from restoring the reef (such as water purification, nitrogen sequestration and water and biogeochemical cycling), which could help recoup the cost of investment (Knoche and Ihde 2018)<sup>b</sup>.

<sup>a</sup> This project focused on the first three tributaries in Maryland chosen for restoration: Harris Creek, the Little Choptank River and the Tred Avon River. The projected cost for achieving the total restoration acreage target was \$72 million; actual costs incurred to this point have been \$53 million.

<sup>b</sup> Knoche and Ihde (2018) used IMPLAN regional economic impact modelling software to calculate the economic effects for four key economic measures (output, labour income, value-added and employment). There are a number of limitations to using ecological and regional impact modelling studies. For example, the ecological model implicitly assumes that catchability is constant and also excludes key ecosystem services from oyster reefs. While the authors did not carry out a benefit-cost analysis per se, based on the estimates calculated and the missing value of the ecosystem services, we ascertain the benefits are likely to outweigh the cost of investment.

## Box 7. Debt-for-Nature Swaps to Advance Marine Protected Areas

Since 2008, when Seychelles defaulted on its national debt, the country has since sought ways to preserve its natural environment—the pillar of its economy and of its citizens' livelihoods—without endangering financial stability. In 2015, The Nature Conservancy and its impact investing unit, NatureVest, brokered a deal to restructure a portion of Seychelles' debt with a debt-for-nature swap. The deal allows the government to restructure the country's debt with a mix of investments and grants, in exchange for designating 30 percent of its exclusive economic zone (EEZ) as a marine protected area. The agreement frees capital streams and directs debt service payments to fund climate change adaptation and marine conservation activities that will improve the management of Seychelles' coastlines, coral reefs and mangroves. This is the first time this financing technique has been used for the marine environment (Thande 2018).

The designation of the 30 percent of the EEZ took place during the COVID-19 crisis, on 26 March 2020, and demonstrated the continued commitment of Seychelles to marine protection as a core aspect of its long-term strategy for economic sustainability (Statehouse 2020).

In 2018, the Republic of Seychelles complemented its debt restructure through the debt-for-nature swap by establishing the world's first sovereign blue bond. The blue bond was created in partnership with impact investors (private capital) and public multilateral bodies (the World Bank and Global Environment Facility) to finance the necessary shift to sustainable management and governance of fisheries in Seychelles. The beneficiaries of the proceeds of the blue bond will be local communities, civil society organisations

and businesses who are seeking financing for activities that can support a transition to sustainable fisheries. The bond was issued with a ceiling value of US\$15 million, with a maturity of 10 years. The World Bank provided support through a partial guarantee (\$5 million), and the Global Environment Facility provided a concessional loan (\$5 million), which will subsidise payment of the bond coupons. These credit enhancement instruments allowed for a reduction of the price of the bond by partially de-risking the investment of the impact investors, and by reducing the effective interest rate of 6.5 percent for Seychelles to 2.8 percent by subsidising the coupons (World Bank 2018).

Despite significant changes to national budgets and revenues as a result of the impacts suffered from COVID-19, the sovereign blue bond has continued to fund recovery efforts and economic diversification initiatives across Seychelles to aid in recovery efforts. This includes over \$700,000 in grants for ocean conservation and management and \$12 million to fund research and development for new economic opportunities.

Seychelles is also undertaking extensive mapping of its seagrass ecosystems, aiming to map the entire EEZ to enable inclusion of these ecosystems and the associated adaptation blue carbon benefits for inclusion in its nationally determined contribution (NDC) under the Paris Agreement to be submitted this year and a commitment towards integrating carbon accounting for the blue carbon ecosystems in the NDCs ahead using the Wetlands Supplement of the Intergovernmental Panel on Climate Change.



## Two: Invest in Sewerage and Wastewater Infrastructure for Coastal Communities

Wastewater and sewage runoff into coastal waters (resulting in eutrophication and hypoxia) is a major contributor to human health issues, spreads water-borne diseases among coastal communities, contributes to the loss of local fish stocks (and therefore contributes to local food insecurity and loss of revenue for small-scale fishers), furthers the decline of coral (and therefore undermines opportunities for ecotourism) and results in costly beach closures for coastal communities and tourism (WWAP 2017)<sup>48</sup>.

More than 80 percent of global wastewater flows are released without adequate treatment, with this figure as high as 95 percent in some least developed countries (ILO 2017). Much of this runoff comes from agricultural sources, where inefficient use of fertiliser and inadequate wastewater treatment leads to nitrogen and phosphorous loading in waterways and

groundwater. Excess nitrogen and phosphorus often lead to eutrophication, harmful algal blooms and ocean hypoxia (UNEP et al. 2012). Even where treatment facilities exist, they may sometimes discharge untreated sewage into waterways and the ocean due to decayed infrastructure, facility malfunctions or heavy rainfall events that overwhelm systems using combined sewers and stormwater drains (Jambeck et al. 2020; Malik et al. 2020).

Over the last 30 years, wastewater and sewage runoff has cost the global economy an estimated \$200 billion to \$800 billion per year (UNDP 2012).

The estimated rates of return on water and sanitation investments are striking, with every \$1 invested in water, sanitation and hygiene having a potential return of \$3–34, depending on the region and technology involved (Hutton et al. 2004).

In the face of ever-growing demand for water, wastewater is increasingly seen as a reliable alternative source of water, shifting the paradigm of wastewater management from ‘treatment and disposal’ to ‘reuse, recycle and resource recovery’ and offering even greater benefits. In the context of a circular economy, whereby economic development is balanced with the protection of natural resources and environmental sustainability, wastewater represents a widely available and valuable resource (WWAP 2017).

### WHY INVESTMENT MAKES SENSE

**The development of the infrastructure for sewage and wastewater treatment and reuse can offer immediate job opportunities for local communities in coastal areas.** Analysis of stimulus packages in Latin America from the 2008–9 financial crisis aimed at investment in public works found that investing \$1 billion in water supply and sanitation network expansion could result in the creation of up to 100,000 direct jobs annually (significantly higher than the same investment in coal-powered energy) (Schwartz et al. 2009)<sup>49</sup>. In the United

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48. Bacteria use up oxygen in the water as they decompose the organic material in the wastewater, and the resulting lack of oxygen in the water kills the fish. The solids in sewage cause the water to appear dark and murky, which also affects the ability of fish to breathe and see around them.

49. Note that Schwartz et al.'s (2009) study looks across multiple countries and projects aimed at water and sanitation. The figures provided in this report were for Columbia's expansion of its water supply and sanitation network. For the full details, including figures for other countries and types of investment, see Table 2 in Schwartz et al. (2009). The investment includes both water and sewage treatment. The direct employment-generation potential of an investment is thus highly sensitive to assumptions about wages, the division between skilled and unskilled workers, the sectoral allocation of the proposed program, the technology to be employed in each project and the potential crowding-out or substitution effects. Indirect job estimates are also highly sensitive to leakage created from the division between locally produced and imported inputs.

States, investments in sustainable water practices are estimated to generate between 10 and 15 direct, indirect and induced jobs per \$1 million invested in alternative water supplies; between 5 and 20 direct, indirect and induced jobs per \$1 million invested in stormwater management; between 12 and 22 direct, indirect and induced jobs per \$1 million invested in urban conservation and efficiency; and between 10 and 72 direct, indirect and induced jobs per \$1 million invested in restoration and remediation (Pacific Institute 2013). Investing in green infrastructure, such as riparian buffers to address agricultural runoff, could also be a cost-efficient alternative to typical grey infrastructure. When compared to the creation of a new nitrate-removal facility, the planting of a riparian buffer offered a cost savings of up to \$29 million (Canning and Stillwell 2018). Reforms and incentives promoting recovery and reuse of wastewater (such as retrofitting homes and apartment buildings for composting, collection and reuse of human waste as fertiliser) are typically much more labour-intensive than current/traditional 'linear' municipal wastewater collection, treatment and disposal systems, leading to net job creation in both the private and public sectors. For example, as a result of concerted policy and investment, Israel now reuses 80 percent of its wastewater for agricultural production. This has led to a fivefold increase in the export of water technology, leading to a \$2 billion industry between 2008 and 2013 (Hudson 2017).

**Investment in sewage and wastewater treatment and reuse can avoid long-term costs (in terms of loss of biodiversity, tourism revenues and wider recreational benefits) as a result untreated wastewater being discharged into coastal waters.** The longer-term economic benefits of investment in waste and sewerage infrastructure are twofold. First, clean coastal waters will bring economic benefits to communities and businesses that rely on tourism revenue. Cleaner waters and healthier coastal ecosystems offer additional

opportunities for ecotourism and revenue-generating activities. Second, such investment avoids the economic loss suffered through inaction. The degradation of coral reefs due to pollution and overfishing caused the Caribbean to lose \$95 million to \$140 million per year in net revenue from coral reef-associated fisheries, \$100 million to \$300 million per year in reduced tourism revenue and \$140 million to \$420 million per year in reduced coastal protection (Burke et al. 2011)<sup>50</sup>. On a more local scale are the economic losses suffered by coastal business and tourism ventures from beach closures as a result of pollution. Furthermore, the integration of green infrastructure with traditional grey infrastructure for the recovery and reuse of wastewater has been shown to offer significant improvements and long-term economic savings for local authorities. In 2007, the city of Portland, Oregon, introduced a program to spur the use of green infrastructure for urban stormwater management. As a result, service providers installed permeable pavements and bioswales throughout the city, reducing peak flow by 80 to 94 percent in target areas. Estimates indicate the initial \$9 million investment in green infrastructure has yielded a savings of \$224 million in stormwater costs related to repairs and maintenance (EPA 2010). A review of the U.S. water and wastewater infrastructure estimated that meeting the nation's projected needs would require an additional investment of \$82 billion per year for the next 10 years, but the review also found that this investment would result in over \$220 billion in total annual economic activity, approximately 1.3 million jobs and productivity savings for U.S. businesses of approximately \$94 billion a year<sup>51</sup> (Value of Water Campaign 2017).

**Proper wastewater treatment and reuse facilities and sewerage infrastructure will improve the health of the local community, prevent future water-borne diseases, increase water security and reduce inequalities.** Improved waste management has direct gender and social equity implications, and addressing

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50. The loss of economic value from degradation of reef goes beyond the estimated tourism revenue, as it includes both use value (e.g. recreational fishing, surfing or beach-going) and non-use values. Non-use value includes the value of preserving the ecosystem for future use either by an individual (option value) or by future generations (bequest values). In addition, there is existence value, which is unrelated to the use of the resource and represents the willingness to pay for the resource to exist (e.g. willingness to pay for the protection of a beach you will never visit). Non-use value is often difficult to quantify, and hence the economic losses tend to be larger than the market values estimated.

51. If the water infrastructure gap is not addressed, businesses would face higher costs to procure water and wastewater services. These costs include operational and maintenance costs, higher water rates, costs of self-supply or costs of relocating to a better-served area.

this issue would also lead to improved social equity outcomes in associated communities (Satterthwaite et al. 2019). Targeted water investments may contribute to reaching growth and poverty alleviation goals more effectively (UN Water 2016). Globally, unsafe sanitation costs an estimated \$223 billion a year in the form of high health costs and lost productivity and wages (WHO 2012). Investment in safe drinking water and basic sanitation could offer estimated economic returns of \$3–34<sup>52</sup> globally for every \$1 invested, with an overall estimated gain of 1.5 percent in global GDP (Hutton et al. 2004). These returns include both health benefits (such economic benefits from reduction in water-borne diseases) and non-health benefits (such as time savings associated with better access). Investment in small-scale projects providing access to safe water and basic sanitation in Africa could offer an estimated economic return of about \$28.4 billion a year, or nearly 5 percent of the continent’s GDP (UNESCO 2009). Improving employment is a good economic outcome; sound health and social equity outcomes are also important enabling conditions for resilient communities.

A reduction of untreated wastewater being discharged into coastal waters will improve local water quality and reduce stressors on coral reefs and coastal ecosystems, and reuse can offer climate-mitigation benefits. Reducing the nutrient runoff will reduce a significant stressor on coral reefs and shellfish (especially bivalves that filter large quantities of water) resulting in improved and more resilient coastal and marine ecosystems and improved local water quality. Energy from wastewater and sewage treatment can be recovered in the form of biogas, heating and cooling, and electricity generation. Technologies exist for on-site energy recovery through sludge and biosolids treatment processes integrated into wastewater treatment plants, allowing them to transition from major energy consumers to energy neutrality, or even to net energy producers. Energy recovery can also help facilities reduce operational costs and their

carbon footprint, enabling increased revenue streams through carbon credits and carbon-trading programmes (WWAP 2017).

#### HOW THESE BENEFITS CAN BE ACHIEVED: SHORT-TERM INTERVENTIONS THAT CAN BE INITIATED NOW AS PART OF STIMULUS SPENDING AND RECOVERY MEASURES

- **Commit public funding for decentralised, low-cost solutions and safe water reuse options in coastal areas.** Large-scale centralised wastewater treatment systems may no longer be the most viable option for urban water management in many countries. Decentralised wastewater treatment systems, serving individual or small groups of properties, allow for the recovery of nutrients and energy, save freshwater and help secure access to water in times of scarcity. It has been estimated that the investment costs for these treatment facilities represent only 20–50 percent of conventional treatment plants, with even lower operation and maintenance costs (in the range of 5–25 percent of those of conventional activated sludge treatment plants) (WWAP 2017).
- **Commit public funding for the development of services which can collect and transport sanitation waste for safe treatment.** This is often one of the main barriers to effective sanitation and can be a source of decent jobs for local and regional communities.
- **Establish a sustainable financing mechanism (e.g. a dedicated national fund) for sanitation.** A major barrier to improved and accessible sanitation facilities is low levels of public investment in the sanitation sector. The creation of an enabling framework and dedicated fund can attract both public and private sector funding and investment for resource mobilisation and guarantee the necessary funds at a national level for investment in the sector.

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52. Returns are dependent on the region and technology used (Hutton et al. 2004). The benefits also refer to improving the quality of groundwater (which we use as a proxy). The estimates refer to the following intervention: halving the proportion of people who do not have access to improved water sources and improved sanitation facilities by 2015. ‘Improved’ water supply involved better access and protected water sources (e.g. stand post, borehole, protected spring or well, or collected rainwater). Improvement does not mean that the water is safe, but it is more accessible, and some measures are taken to protect the water source from contamination. ‘Improved’ sanitation, generally involving better access and safer disposal of excreta (septic tank, pour-flush, simple pit latrine, small bore sewer or ventilated improved pit latrine).

- **Incentivise management strategies such as implementing riparian buffers or reducing inefficient fertiliser use to reduce nutrient pollution.** Ecosystems can effectively provide economical wastewater treatment services, as long as these ecosystems are healthy, the pollutant load (and types of contaminants) in the effluent is regulated and the ecosystem’s pollution assimilation capacity is not exceeded (WWAP 2017).

### Three: Invest in Sustainable Community-Led Non-fed Mariculture

Given the changing nature of the fisheries industry in a post-COVID-19 world and the increasing importance of ensuring local food security and economic diversification, investment in community-led non-fed marine aquaculture (mariculture) (e.g. shellfish and seaweed farming)<sup>53</sup> offers considerable opportunities. Non-fed mariculture has the greatest potential to contribute to food supply and make the global food system more resilient (Costello et al. 2019; SAPEA 2017; Duarte et al. 2009). Such mariculture requires no feed, fertiliser inputs, insecticides or antibiotics, and it requires less water and energy than fed aquaculture, making it a self-supporting system (Roberts et al. 2015; Suplicy 2018). The development of sustainable community-led mariculture could also provide local employment and strong ecosystem services in countries with climate-driven declines in capture fisheries (Costello et al. 2019).

Potentially 48 million km<sup>2</sup> of the world’s ocean is suitable (based on nutrient availability and temperature) for seaweed cultivation<sup>54</sup>. These waters span 132 countries, of which only 37 are currently cultivating (Froehlich et al. 2019). In terms of bivalve production, Gentry et al. (2017) found that over 1.5 million km<sup>2</sup> (roughly the area of Mongolia or Iran) of marine habitat, spanning temperate and tropical regions, are suitable for bivalve production (e.g. oysters, mussels, clams) and that developing small suitable areas can result in high production volume (e.g.

they found that developing just 1 percent of Indonesia’s suitable area could produce over 3.9 billion individual bivalves).

Investment in sustainable community-led mariculture could protect and develop mariculture with the triple goal of producing high-quality protein, accelerating a shift towards sustainable food systems, and maintaining and restoring ocean ecosystem services.

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Note that for some countries investment in developing sustainable feed alternatives for fed mariculture (e.g. finfish) might be a priority over investment in developing community-based non-fed mariculture (e.g. those countries that have very advanced fed mariculture industries, such as Norway and Chile). Important technological, nutritional and economic constraints remain to feed substitution, and many substitutes being explored are currently too expensive to incorporate in large-scale production (Naylor et al. 2009). As such, this has not been considered a priority applicable to multiple regions and economies to respond to the current

53. Non-fed mariculture is for species that do not require human-derived feed inputs and instead extract resources from the surrounding environment (e.g. phytoplankton), primarily macroalgae and bivalves (e.g. oysters, mussels and scallops).

54. We are not suggesting that all 48 million km<sup>2</sup> be developed, as this would amount to large-scale cultivation that would not be compatible with a community-led approach and would likely result in unintended consequences through the disruption of coastal ecosystems and their functioning. We provide the area figure to show that potential is not limited to one region or a small group of countries.

economic crisis. Benefits associated with investment in research and development for alternative feed are explored in Annex A.

#### WHY INVESTMENT MAKES SENSE

**Community-led non-fed mariculture creates jobs for local communities and requires comparatively less initial investment than larger-scale commercial mariculture.** The potential for job creation is significant, predominantly in developing and emerging economies, with a focus on economic opportunity for women (see Box 8). In Indonesia, women play a significant role in seaweed farming, resulting in some women becoming the main household earner despite previously earning little income (Neish 2013). Women relatives of seaweed farmers were also found to be instrumental in tying seed (Valderrama et al. 2013). Seaweed farmers were shown between 2007 and 2009 to make up to \$5,000 per year, a 33 percent higher income than the national average (\$3,603) (Neish 2013). As of 2019, women made up 57 percent of the communities engaged in mabé pearl farming in Fiji, with sales ranging from F\$735 to F\$2,200 (US\$346–1,038) per crop (Southgate et al. 2019).

**Community-led non-fed mariculture can support long-term economic diversification for local communities.** In addition to the direct benefits for local communities, seaweed mariculture offers a sustainable and low-carbon alternative for products such as biofuels (Jiang et al. 2016)<sup>55</sup> aquaculture and agriculture feedstocks, and plastic (Önen Cinar et al. 2020). The estimated value of micro-algae oil for people and animals from 500 million metric tons of seaweed is \$23 billion (Bjerregaard et al. 2016). Extrapolating an estimate of 1 job per 10 dry tons of seaweed results in a potential direct employment of 50 million jobs; a standard seafood industry secondary-employment multiplier of 2:1 suggests 100 million jobs could be created overall (based on an estimate of 1 job created per 10 dry metric tons), roughly the number currently

employed in marine capture fisheries (Bjerregaard et al. 2016)<sup>56</sup>. Bivalve mariculture offers significant opportunities for the creation of a green and circular local economy. Goods from provisioning services include meat, worth an estimated \$23.9 billion as well as pearls, shell and poultry grit, with oyster shell being the most important, with a global potential worth of \$5.2 billion (Olivier et al. 2020). Shells can be used as construction material, fertiliser, poultry grit and artistic products. Research on the potential of bivalves as medicinal and genetic resources is on the rise, looking at their bioactive peptides, proteins and metabolites for producing innovative pharmaceuticals and nutraceutical foods. Mussel byssus—highly resistant fibre that combines high extensibility and harness and is the only effective glue underwater—has particularly interesting potential applications in engineering, biological and biomedical fields, including in water-resistant adhesives, replacement of surgical sutures, bone prostheses and fibre optics (Zhang et al. 2020; Guo et al. 2020).

**The opportunity for community-led mariculture supports improved rural livelihoods, particularly for women, as well as cultural services for coastal communities.** The expansion of seaweed farming in several continents is contributing to global food security, supporting rural livelihoods and alleviating poverty (Cottier-Cook et al. 2016). Some fast-growing species can be cultivated year-round, and yield per unit area can surpass that of terrestrial crops (Forster and Radulovich 2015). Bivalve farming also provides many cultural services for communities and visitors, including links with the marine environment, a strong connection with cultural heritage and educational centres on ecosystems (Alleway et al. 2018; McLeod and McLeod 2019). A global assessment values the global, non-food bivalve mariculture services, including cultural services, at up to \$6.47 billion per year—a figure recognised as an underestimate given existing data gaps (Olivier et al. 2020).

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55. Marine algal biofuel is considered a promising solution for energy and environmental challenges. Macroalgal biomass has the potential for bypassing the shortcoming of first and second generation of biomass from food crop and lignocellulosic sources.

56. Note that the micro-algae used as a replacement for fish oil are more likely to be cultivated in tanks in deserts with unlimited sun. All the recent big investments in fish oil substitutes have been in these kind of micro-algae, not ocean-grown macro-algae, where the promising segments are more those used for food, animal feed, fertilisers (biostimulants) and bioplastics.



**Increased community-led mariculture offers opportunities for GHG emissions reduction through the use of seaweed for alternative feed and fuel and promotion of oysters and mussels as a low-carbon alternative protein.** Projections of annual global GHG emissions reductions from seaweed farming are between 0.05–0.29 GtCO<sub>2</sub>e/year by 2050. This would be equivalent to taking approximately 1–6 million vehicles off the road every year<sup>57</sup>. However, there are uncertainties in rates of expansion of the industry and the proportion of production that would be sequestered (Hoegh-Guldberg et al. 2019). It is estimated that seaweed could create a carbon-neutral mariculture sector with just 14 percent of current seaweed production, with seaweed culturing at a regional level more feasible from a cost perspective, especially in areas with strong climate policy, such as California (Froehlich et al. 2019)<sup>58</sup>. The addition of seaweeds to animal feed to reduce enteric methane emissions from ruminants may substantially increase the mitigation potential of seaweeds (Kinley et al. 2016). Small-scale community seaweed farming projects are considered low-risk, but significant expansion would require a more complete understanding of how risks and benefits change as projects are scaled (Campbell et al. 2020), in addition to any potential trade-offs with other ecosystem values and uses. If not appropriately located, seaweed farms could also affect seagrass beds and other benthic habitats and thereby disturb the local ecology (Eklöf et al. 2005). Spatial planning, ongoing monitoring and proper management are key to mitigating these impacts and informing design of a system that promotes resilience, local empowerment and long-term conservation of marine and coastal ecosystems.

Bivalves contribute to the carbon cycle, serving as a carbon sink as their shells develop. In France, 250,000 metric tons of farmed shellfish (mainly oysters and mussels) sequester 9.2 metric tons of carbon each year, as much sequestration as is done by half of the Landes, the largest forest in the country (CNC n.d.). This

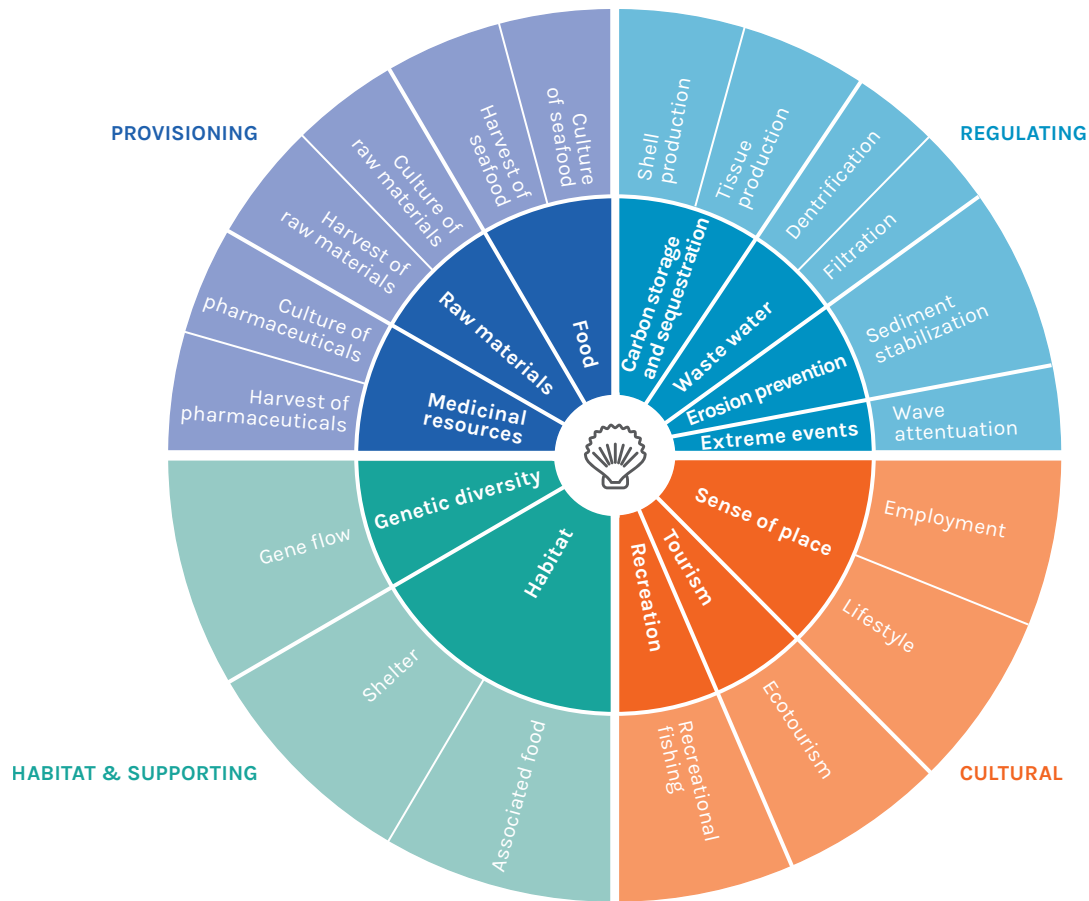
benefit is not offset by carbon emissions associated with production, which remain low. Studies found that mussel farming has one of the lowest carbon footprints of any food production system, and may in fact have the lowest. It probably offers the best ratio of protein quality and climate and ecosystem benefits (SARF 2011; Suplicy 2018). Bivalve production could significantly contribute to promote low-carbon food systems and reduce meat production. A plate of mussels (approximately 500 grams in weight, which includes 150 grams of flesh) provides as much protein as two eggs and more iron than a piece of red meat while offering calcium, magnesium and daily needs in iodine (CNC n.d.). This comes with a very low environmental footprint compared to meat production (most comparisons look at beef and chicken production) and fisheries, in terms of carbon emissions, water use and non-renewable energy consumption (Alleway et al. 2018; Hughes et al. 2018; McLeod and McLeod 2019; Deletraz et al. 2020). In addition, bivalves function in a variety of ecosystems, such as estuaries, lagoons and coastal oceanic systems, while providing a multitude of services. As captured in Figure 4, these include habitat and supporting, provisioning, regulating and cultural services. As filter feeders, bivalves purify water (up to 180 litres—50 gallons—of water a day for an adult oyster, 25–30 litres for a mussel) while treating waste (including hydrocarbons). This function enhances water clarity and helps control excessive phytoplankton blooms (Bricker et al. 2018; Alleway et al. 2018; Ferreira et al. 2018; Hughes et al. 2018; McLeod and McLeod 2019).

**Mussel farming has one of the lowest carbon footprints of any food production system**

57. Based on the average emissions of a passenger vehicle being 4.6 metric tons per year, according to EPA (2018).

58. Research has found that some fundamental and very significant hurdles remain to realising the potential contributions of seaweed cultivation at a global level. For example, the value of seaweed biomass needs to be improved, and the ecosystem services that seaweed farming can provide (such as in reducing coastal nutrient loads) need to be more fully considered. Additional considerations are environmental risks associated with climate change, pathogens, epibionts and grazers, as well as the preservation of the genetic diversity of cultivated seaweeds (Buschmann et al. 2017).

**Figure 4.** Goods and Services Provided by Shellfish Mariculture



Source: Alleway et al. (2018).

**HOW THESE BENEFITS CAN BE ACHIEVED: SHORT-TERM INTERVENTIONS THAT CAN BE INITIATED NOW AS PART OF STIMULUS SPENDING AND RECOVERY MEASURES**

- **Feasibility studies and associated zoning (ideally guided by an integrated ocean management or marine spatial planning process).** Spatial planning approaches in which biotic, abiotic and socioeconomic factors are considered could be used to identify where the positive effects of mariculture could be maximised (Alleway et al. 2018). This initial scoping work can also be a source of short-term job creation for local universities and scientists.
- **Streamlined and centralised permitting and regulatory processes.** The purpose of streamlined permitting is not to cut corners or skip necessary

environmental impact assessments for new projects but rather to ensure that local communities and applicants can access and easily navigate the government process. Otherwise this process can be a significant barrier to communities' ability to initiate projects (even with funding).

- **Government grants and loans for new seaweed and/or bivalve farmers (including microloans).** The high upfront costs that these production systems involve represent a barrier for community-led projects in many countries (see Box 8 for an exploration of how the Kenyan government has helped stimulate the creation of community-led maricultural in partnership with the World Bank).
- Investment in communities of practice across different regions. With relatively small upfront investment, the capacity of small-scale and

community-led initiatives can be accelerated by establishing regional communities of practice to share knowledge, experiences and best practice across the industry.

- **Creation of capacity-building and training programs for local communities.** These programs and opportunities could be prioritised for those communities most affected by reduced economic opportunities from tourism and lower demand from fisheries. See also Section 3.3 for recommendations on investment in research and development and skills-training programs for sustainable ocean industries.

- **Facilitation of cooperative and co-designed sites across multiple sectors and with the private sector.**

Co-designed initiatives could support development across a multitude of sectors (e.g. energy, transport, communication), to co-produce ecosystem services to support the needs and interests of multiple stakeholders (Outeiro et al. 2017). For example, offshore wind farms could provide a platform to which mariculture facilities could be attached, the operational costs of which might otherwise be prohibitive or the space and location required contested (Buck et al. 2018).

## Box 8. Scaling Community Seaweed Farming in Kenya

Kenya started community seaweed farming in Kwale County on the South Coast in 2013, following feasibility studies undertaken by the Kenya Marine and Fisheries Research Institute. The initial funding was from a World Bank-funded project that targeted fishing communities along the Kenyan coast, but further funding has been provided by the Government of Kenya to build the farmers' capacity with the aim of developing the initiative into a robust industry to create jobs and income. The main objective of supporting the establishment of this new community-led industry was to offer an alternative livelihood to local fishing communities whose livelihoods had been challenged by reduced income due to the dwindling catches from artisanal fisheries. Importantly, it was also an intervention that specifically supported the creation of new jobs and economic opportunities for women—90 percent of seaweed farmers in Kenya are women.

To date, this support has resulted in the employment of approximately 400 seaweed farmers in Kwale County, each with his or her own individual farm generating income that flows directly to the farmer. For the women involved, this has meant financial independence from their husbands, with many using the income from their seaweed farms to educate their children up to the university level and constructing permanent houses.

The sale price of the dry seaweed is agreed upon with the buyers prior to the transactions, and plans are underway to have a contract between the farmers and the buyers. The seaweed farmers welfare group has also been registered

as a cooperative to improve organisation and collective bargaining power. The Government of Kenya has provided additional support to the farmers to ensure effective post-harvest management, provision of farming implements, harvesting and storage facilities, value addition and marketing. The seaweed is also being used in local food products. Support is also being provided to diversify the farmers' income base through the development of soap and other cosmetic products, such as body creams, shampoos and hair treatment. To date, community-led seaweed farming has generated over 300 metric tons of dry seaweed that has generated over US\$60,000 for the local village economies.

Some of the challenges faced in developing the initiative into a commercial entity include raising the level of production to volumes that make business sense to the potential investors and traders, particularly owing to the fact that the activity is a nontraditional economic activity, new to the farming communities. The difficulty of finding a reliable market for the produce, without economically feasible production volumes, affected the ability to reach scale. Extensive training of the communities has gotten more committed farmers and thus increased production volumes. The other major challenge has been extreme weather patterns, including very high temperatures followed by very heavy and extended rainfall, which resulted in massive die-off of seaweeds. This near complete loss of seaweed seed has been resolved by establishing new nurseries at the start of the favourable season (southeast monsoon) by bringing in seaweed from more sheltered sites.

## Box 8. Scaling Community Seaweed Farming in Kenya, continued

As a result of the demonstrated socioeconomic benefits of community seaweed farming in Kwale County, and the engagement of a commercial seaweed buyer, Kenya is now looking to scale the industry along the South Coast and ultimately the rest of the coast. For Kenya, the immediate socioeconomic impact of investment in community seaweed farming makes it a priority intervention for economic recovery, as its relatively low investment, quick returns and broader social and environmental benefits make its uptake and scalability more feasible than other interventions.

Seaweed farming can be approached as integrated multi-trophic mariculture. Incorporating cages, bivalves and sea cucumbers optimises the productivity of a unit area of sea space and creates more employment. Additionally, seaweed helps clean coastal waters of excess nutrients that have been introduced through pollution and wastewater, making it the ideal crop for environmental sustainability.

The Government of Kenya is currently supporting the selection of further suitable sites and associated environmental impact assessment to scale the initiative.

*Source: Information provided by the Government of Kenya, 2020.*

### Four: Incentivise Zero-Emission Marine Transport

Global supply chains rely on marine transport to move approximately 90 percent of global trade. Regional and intercontinental shipping constitutes the core of the global logistical system. At any given time 50,000 vessels and 1.2 million seafarers are in operation between ports in different parts of the world. Marine transport is also the mode of long-distance transport with the lowest carbon footprint and cost (WSC 2020).

The sustainability and viability of this industry is critical for ensuring the resilience of global populations to future shocks. During COVID-19 shipping has been responsible for transporting essential goods and services globally, from PPE to the core elements needed for the production of vaccines. In terms of domestic marine transport, it has been the only form of transport for food, health provisions and basic essentials between islands and atolls.

Despite its central role in ensuring that global supply lines remain open, the industry has faced a significant contraction (estimates of between 25–35 percent by the end of the year) (NSA 2020a) as global trade has dropped. Recovery offers an opportunity to scale investment in the future of this industry through supporting and incentivising industry to invest in the decarbonisation of its fleets. The average lifespan of a cargo vessel is 25–30

years. To enable these vessels to be aligned with the Paris Agreement requires upfront investment over the next few years to keep high-emitting ships and vessels from becoming stranded assets.

Marine transport is not limited to deep-water vessels and cargo shipping, however. Domestic fleets, including fishing and mariculture fleets, vessels that form national navies and coastal passenger transport make up large proportions of a country's transport footprint. Marine transport used in the tourism industry (cruise ships as well as coastal passenger fleets associated with hotels and resorts) stand to gain from early investment in their sustainability and decarbonisation.

An ancillary effect of the global contraction is an expected increase in vessel recycling, particularly for offshore and passenger ships (NSA 2020a). This provides the opportunity for government investment to not only support and incentivise investment in replacement fleets and retrofitting but also ensure environmentally sound and sustainable ship-recycling practices.

Regarding the economic, social and environmental net benefits, analysis shows that investments to decarbonise the international maritime shipping sector could deliver a net discounted benefit (average) over 30 years (2020–50) of \$1.2 trillion to \$9 trillion (Konar and Ding 2020), with a benefit-cost ratio of 2:1 and 5:1 in 2050<sup>59</sup>. Similar figures are not yet available for domestic fleets.

59. The analysis excludes military and fishing vessels and domestic transport and includes bulk carriers, oil tankers and container ships, which account for the majority (55 percent) of emissions in the shipping sector (Olmer et al. 2017).

## WHY INVESTMENT MAKES SENSE

**Investment in the shipping industry to support efforts to retrofit or replace high-emitting vessels with low- or zero-emission vessels will protect jobs in the short term.** Due to the contraction of the industry, market demand for new vessels is likely to decrease, threatening existing jobs. Government investment at this time would protect jobs and enable upskilling to support new zero-emission technologies. Supporting the replacement of domestic vessels with zero-carbon alternatives can create sustainable jobs, both by reducing domestic emissions and by preparing shipyards for future demand for zero-emission deep-sea vessels once demand picks up after COVID-19.

**Investment now will yield long-term benefits for the industry as well as other sectors, including tourism, that rely on marine transport.** Zero-emission coastal transport (e.g. passenger and car ferries) can be more cost-efficient to run than its high-emitting counterparts (European Commission 2018). Shifting the demand from oil to alternative fuels and battery propulsion can be a catalyst to scale the deployment of low-carbon fuels for the broader energy transition and unlocks the market for these fuels across a range of industries and other hard-to-abate sectors (Moore 2019). This is due to shipping's high level of fuel consumption, currently estimated to be around 250 million to 300 million metric tons every year, approximately 4 percent of the global oil demand (Christensen 2020). Decarbonising the shipping sector will increase confidence among suppliers of future fuels (e.g. hydrogen and ammonia) and offers opportunities for synergies with efforts to accelerate and scale the establishment of ocean-based renewable energy (see the preceding section). Annex A describes specific additional interventions that can target the establishment of these industries for alternative fuel generation.

**Decarbonisation of marine transport, both international and domestic, offers significant health benefits for those on board the vessel as well as coastal communities and those living near or working at the port.** Prior to cleaner ship fuels, ship-related health impacts included around 400,000 premature deaths from lung cancer and cardiovascular disease and around 14 million childhood asthma

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cases annually. Reduced PM2.5 from marine engine combustion mitigates ship-related premature mortality and morbidity (Sofiev et al. 2018). Based on this, analysis estimates the discounted cumulative health benefits from reducing emissions from marine transport to be \$1.3 trillion to \$9.8 trillion over 30 years (2020–50) (Konar and Ding 2020).

**Reducing GHG emissions from shipping vessels will help mitigate ocean acidification and contribute to domestic and global efforts to reduce GHG emissions.**

Ocean-based transportation could reduce operational net GHG emissions roughly 100 percent by changing the way it stores and consumes energy on board (e.g. use of batteries and zero-emission fuels such as hydrogen and ammonia). If the full suite of available technologies is employed, and zero-emission vessels are available for commercial use by 2030, global GHG emissions could be reduced by between 0.9 and 1.8 GtCO<sub>2</sub>e/year in 2050 (Hoegh-Guldberg et al. 2019). This would be equivalent to taking 19–39 million cars off the road every year<sup>60</sup>. In terms of environmental benefits, the strong acids formed from shipping emissions can produce seasonal ‘hotspots’ of ocean acidification in ocean areas close to busy shipping lanes. Hotspots have negative effects on local marine ecology and commercially farmed seafood species (Hassellöv et al. 2013). Lastly, the shift to zero-emission vessels could reduce the noise impact on marine mammals. The effects of underwater noise from anthropogenic activities, including ships, on marine mammals includes behavioural responses, acoustic

60. Based on the average emissions of a passenger vehicle being 4.6 metric tons per year, according to EPA (2018).



interference (i.e. masking), temporary or permanent shifts in hearing threshold, and stress (Erbe et al. 2019). Studies have shown that periods with a significant reduction in noise from ship traffic have been associated with a reduction in the stress of whale populations (Rolland et al. 2012). Moving to zero-emission vessels such as fuel cell and battery-powered could eliminate noise pollution (Reddy et al. 2019). Research also shows that this shift could be coupled with a 20 percent reduction in speeds, which would reduce underwater noise pollution by 66 percent, the chance of a fatal collision between a ship and a whale by 78 percent and CO<sub>2</sub> emissions by 24 percent (Seas at Risk 2019).

#### HOW THESE BENEFITS CAN BE ACHIEVED: SHORT-TERM INTERVENTIONS THAT CAN BE INITIATED NOW AS PART OF STIMULUS SPENDING AND RECOVERY MEASURES

- **Incentivise investment in upgrading coastal passenger transport (ferries) to zero-emission (battery- or hydrogen-powered) through subsidies, taxes and grants to the private sector.** Investing in coastal passenger transport offers immediate health benefits for coastal communities and new opportunities to stimulate ecotourism. It also improves the resilience of coastal communities that depend on these forms of transport (e.g. between islands and atolls).
- **Commit to use domestic fleets to pilot and test zero-emission fuels and technologies, which in turn can help to de-risk and reduce costs for larger, high-seas and ocean-based transportation.** Domestic fleets are populated with smaller ships and therefore better suited to small-scale and short-term pilots and tests. For many countries, the largest marine fleets are those of their navies, offering significant opportunities for domestic leadership and long-term economic resilience and benefits from early investment.
- **Incentivise private sector investment in replacement fleets and retrofitting by offering subsidies, tax cuts and government loans.** Support for the industry (both the shipping and tourism sectors) at this time can take the form of incentives for replacement and/or retrofitting (as appropriate given the nature of the vessel and availability of technology). Note that incentives should be targeted at incentivising zero-emission vessels and not low-carbon ones (e.g. running on liquefied natural gas), since the latter do not have long-term viability for the industry transition and would therefore be only a short-term investment requiring further investment in the future to facilitate the transition to hydrogen or ammonia.
- **As part of stimulus funding packages for infrastructure, allocate public investment to the development of low- and zero-carbon energy production capacities, and storage and refuelling infrastructure in ports and harbours.** Land-based measures will be critical to support the transition for marine transportation and ensure that a clear signal is sent to the private sector.
- **Invest in land-side grid infrastructure.** Lack of investment in land-based infrastructure to support zero-emission vessels is a common barrier. An example from Norway is a hybrid ferry operating between Norway and Sweden that was only able to operate at half its potential because the grid connection in Sweden was insufficient to recharge the batteries on the ferry.
- **Use bilateral aid to support regional partnerships, particularly in support of small island developing states (SIDS) and least developed countries (LDCs) with significant domestic or regional shipping-decarbonisation challenges, to work together on joint objectives.** An example is the Pacific Blue Shipping Partnership, a joint initiative among Pacific nations and led by the Governments of Fiji and the Republic of the Marshall Islands. The partnership commits to zero-carbon domestic marine transport by 2050, with a 40 percent reduction by 2030 (MCST n.d.).
- **Require or establish environmentally sound and sustainable ship-recycling practices that provide decent jobs for local communities.** Ship recycling offers the most environmentally sustainable way of disposing of old vessels, with virtually every part of the hull and machine complex being reused or recycled as scrap metal. To do this properly, ships should be recycled at dry-dock ship-recycling facilities—not beached or exported to countries with

weak regulatory systems. The nexus of ship-recycling yards, refurbishing shops, re-rolling mills, steel mills and second-hand shops creates a localised industry which can employ hundreds of thousands of people in semi-skilled and unskilled jobs.

## Five: Incentivise Sustainable Ocean-Based Renewable Energy

### WHAT INVESTMENT WILL ACHIEVE

According to the International Energy Agency (IEA 2019), global offshore wind power capacity is set to increase 15-fold over the next two decades, turning it into a \$1 trillion business. Only using near-shore sites could supply more than the total amount of electricity consumed worldwide today<sup>61</sup>, and moving further offshore into deeper waters (e.g. using floating turbines) could unlock enough potential to meet the world's total electricity demand 11 times over by 2040<sup>62</sup>. By 2050, the IEA forecasts that offshore wind could reach more than 1,000 gigawatts (GW) of installed capacity. Expansion of offshore wind in line with these projections would put the global power sector on track for full decarbonisation and enable the production of zero-emission fuels (e.g. hydrogen and ammonia) to dramatically cut emissions from sectors such as shipping (IEA 2019)<sup>63</sup>. Although less advanced, other forms of ocean-based renewable energy, such as tidal, wave, sea current and ocean thermal energy conversion, will be highly valuable for many geographies that lack the geophysical requirements to support offshore wind.

Stimulus funding could help fast-track private investment, resulting in job creation in the short term as well as long-term economic growth opportunities.



However, such fast-tracking must not be done at the expense of the marine environment or lead to the use of shortcuts to environmental impact assessments.

Analysis shows that on average there is a net positive benefit from expanding the sector. The net present value of benefits is estimated to be \$300 million to \$6.8 trillion over 30 years for scaling offshore wind production. The return on investment in 2050 is significant, as shown by the benefit-cost ratio, estimated to be 2:1 to 17:1 in 2050 (Konar and Ding 2020). In terms of the benefit-cost ratio per unit of energy generation and transmission, analysis estimates the benefits to be \$75–\$300 per megawatt-hour (MWh) for 1 unit of additional energy production and the ratio range to be between 0.9:1 and 28:1 (Konar and Ding 2020). Estimates show that return on investment increases substantially as the costs of energy generation fall with improved technologies and as actions are taken to reduce integration costs.

61. Offshore wind's technical potential is 3,000 terawatt-hours (TWh) per year for installations in water less than 60 metres deep and within 60 km of shore. Global electricity demand is currently 23,000 TWh (IEA 2019).

62. Offshore wind can generate electricity during all hours of the day and tends to produce more electricity in winter months in Europe, the United States and China, as well as during the monsoon season in India—providing higher value than that of its onshore counterparts and more stable over time than that of solar photovoltaics (PV) (IEA 2019). Capacity factors for onshore wind farms in the European Union average 24 percent, with new farms reaching 30–35 percent. Offshore farms have a capacity factor averaging 38 percent, with new farms reaching 35–55 percent (an increase of more than 50 percent; IEA 2019b). Another advantage is size of turbines. A single 10 MW offshore wind turbine, operating at 60 percent capacity factor, will have output of 51 GWh/year. A solar farm with 25 percent capacity factor, to provide same amount of power, will require ~56,000 PV panels and occupy ~60 hectares of land. The analysts forecast a 60 percent reduction in the costs of turbines, foundation and installations by 2040 (IEA 2019b).

63. These IEA projections are based on expansion in six key markets: Europe, China, the United States, South Korea, Japan and India. Europe, the current market pace-setter with 20 GW installed, is forecast to continue to lead the global pack for the next two decades, with expectations of some 130 GW turning offshore by this date—though China by this point is foreseen as having at least 110 GW online and being on track to outpace Europe's build-out by mid-century. The United States, meanwhile, is forecast to be in line for 'substantial growth' by 2040, with its fleet swelling to around 40 GW, while Korea, India and Japan would all see tens of GW of offshore wind turbines installed.

## WHY INVESTMENT MAKES SENSE

### **Stimulating the creation or expansion of ocean-based renewable energy provides short-term job creation.**

In the early stages of exploring the feasibility of ocean-based renewable energy projects, jobs can be created for engineers, land and marine surveyors, energy specialists, researchers and providers of legal services (see Box 9 for an overview of the initial stages of development of Australia's first offshore wind farm). The opportunity for job creation is generally at the regional and local levels, but the extent of the breakdown will vary by region based on the nature of the wind, tide or wave resource, as well as on the supply chain and labour force. The IEA estimates that offshore wind creates about 1.2 construction jobs per \$1 million invested (for both the construction and manufacturing phases) (IEA 2020a)<sup>64</sup>. In total, the development of a typical 500 MW offshore wind farm requires around 2.1 million person-days of work (IRENA 2019). Estimates in the United States vary from 6 to 44 jobs/MW during construction periods and 0.7 to 1.7 jobs/MW for the projects' ongoing operation (Tegen et al. 2015)<sup>65</sup>. The labour distribution is estimated as 1 percent for project planning, 59 percent for procurement and manufacturing, 0.1 percent for transport, 11 percent for installation and grid connection, 24 percent for operation and maintenance and 5 percent for decommissioning (IRENA 2019). A particular benefit of job creation through offshore wind is that the skills required may be similar to those in offshore oil and gas, enabling benefits to accrue directly to workers transitioning from declining fossil fuel industries (IRENA 2018; Scottish Enterprise 2016), which also minimises the costs of transition and the risks of structural unemployment. The expertise of workers and technicians in building support structures for offshore oil and gas sites, for example, could be leveraged when building foundations and substations for offshore wind turbines. Any such transition must ensure a transfer of

benefits and comparable salary for comparable jobs and/or skill requirements, such as opportunities for union representation.

### **An established ocean-based renewable energy sector creates green jobs, economic diversification into zero-emission fuels and opportunities to co-locate and support other offshore industries.**

The long-term economic benefits associated with a new or expanded ocean-based renewable energy sector include new highly skilled jobs. The OECD estimates that by 2030 the total full-time employment in offshore wind will be 435,000 (OECD 2016)<sup>66</sup>. For offshore wind, an estimated 1 million new jobs will be created by 2050, with an estimated 0.45 million in construction and installation, 0.39 million in manufacturing and 0.17 million in ongoing operations and maintenance (IRENA 2019). For other ocean-based renewables, the sector could create 680,000 jobs by 2050 (OES 2017). The interaction of the offshore wind energy industry with other economic sectors creates the potential for economic diversification and the generation of additional revenue, through both supply chain activities and induced demand for goods and services (IRENA 2018). There is the potential to unlock co-location benefits with other offshore industries; for example, ocean-based renewable energy could meet the increasing demand for energy-intensive desalinated seawater or support mariculture operations. Investment in any form of renewable energy supports the achievement of energy security and independence from imported fossil fuels and associated price volatilities. Lastly, it also creates the opportunity for new green industries in terms of alternative fuel generation (e.g. hydrogen), which can serve as exports or inputs to decarbonisation of other sectors of the economy (such as marine transport). Education and training, however, must be attuned to emerging needs in the ocean renewable energy industry (see Annex A).

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64. Wind power is less labour-intensive than PV solar. Onshore wind power projects create about 1 job in construction and 0.5 in manufacturing per \$1 million invested. Offshore wind creates about one-fifth as many construction jobs but twice the number of manufacturing jobs per unit of investment.

65. For the Southeast region, offshore wind energy development has the potential to support between 14 and 44 full-time equivalent (FTE) jobs/MW during construction periods and 1.6 and 1.7 FTE ongoing (operations phase) jobs/MW; in the Great Lakes, there could be between 6 and 27 FTE jobs/MW installed and 0.7 and 0.8 FTE jobs/MW for the projects' ongoing operation; in the Mid-Atlantic region during construction phases, we estimated a range of 12–30 FTE jobs/MW, and the average for ongoing jobs was 1.2 FTE jobs/MW. The Gulf of Mexico has the potential to support between 25 and 29 FTE jobs/MW during construction and 1.3 FTE jobs/MW on an ongoing basis, for operations and maintenance.

66. Based on previous employment and capacity projections by the IEA (2014) and EWEA (2012), the OECD (2016) estimates that under a business-as-usual scenario, there will be an estimated 435,000 full-time jobs in the offshore wind industry by 2030. This estimate is based on the expectation that more countries will have multiple GW of wind power installed.

**Ocean-based renewable energy offers potential health benefits and desalination of drinking water in coastal communities facing water scarcity.** The health benefits of moving to ocean-based renewable energy for power generation would be significant, particularly for regions that rely more heavily on coal and oil to generate electricity. Offshore wind in the Mid-Atlantic region of the United States could produce health and climate benefits estimated at between \$54 and \$120 per MWh of generation, with the largest simulated facility (3,000 MW off the coast of New Jersey) producing approximately \$690 million in benefits (Buonocore et al. 2016). There is potential to develop ocean energy technologies for a range of purposes, including desalination for drinking water (OES 2011).

**Increasing the share of renewable energy generation and reducing the use of fossil fuels will contribute to national and global efforts to reduce GHG emissions, but efforts to scale ocean-based renewable energy must be done in an environmentally sensitive manner to reduce the impact on marine mammals and ecosystems.** If ocean-based renewable energy technologies displace the current energy generation mix, CO<sub>2</sub> emissions can be reduced by between 0.30 and 1.61 GtCO<sub>2</sub>e/year in 2050 in the case of offshore wind (fixed and floating), and by between 0.05 and 0.87 GtCO<sub>2</sub>e/year in 2050 in the case of ocean-based renewable energy (Hoegh-Guldberg et al. 2019)<sup>67</sup>. Total emission reductions would amount to 0.35 to 2.48 GtCO<sub>2</sub>e/year in 2050 (Hoegh-Guldberg et al. 2019) which is equivalent to taking approximately 35–53 million cars off the road every year<sup>68</sup>. Based on the analysis on avoided damage costs to society from mitigating climate change, we estimate the environmental benefits (net benefit) of reducing greenhouse gases by scaling offshore wind energy generation to be \$344 billion to \$668 billion over 30 years (Konar and Ding 2020). This estimates the costs of displacing the current energy mix with offshore wind energy in line with the projections in Hoegh-Guldberg et al. (2019). Offshore wind uses no water directly, and there should be an overall reduction in freshwater use compared to generating power from fossil fuels (Macknick et al. 2012). Offshore wind structures have positive and long-term effects on marine

species because they provide new habitat in the form of artificial reefs and because fishing, mainly trawling, tends to be restricted in their vicinity (IRENA 2018; Dinh and McKeogh 2019). The risks of installing energy operations in the marine environment include potential biological invasions, noise and disturbance vibrations for marine species, collisions between birds and wind turbine rotors, and the presence of electromagnetic fields that can disrupt marine life and benthic habitats (Sotta 2012; Langhamer 2012). However, studies have shown that there is a gap between the perceived and actual risks of these technologies, with the former arising from uncertainty or lack of definitive data about the real impacts (Copping et al. 2016). The most recent analysis has revealed that the potential impacts of ocean-based energy on marine life are likely small or undetectable (Copping and Hemery 2020). Effective marine spatial planning, in combination with emerging ocean energy technologies, will be effective in mitigating potential biodiversity loss and the risk of collision with seabirds and impacts on migratory cetaceans from ocean energy technologies and in reinforcing biodiversity co-benefits (Hoegh-Guldberg et al. 2019; Best and Halpin 2019). Efforts must also be made to expand renewable energy (both ocean-based and on land) in concert with efforts to improve the circular economy and reduce the reliance of renewable energy technology on rare minerals that would also undermine ocean health if mined from the seafloor (Haugan et al. 2020).

#### HOW THESE BENEFITS CAN BE ACHIEVED: SHORT-TERM INTERVENTIONS THAT CAN BE INITIATED NOW AS PART OF STIMULUS SPENDING AND RECOVERY MEASURES

Investment in research, development and innovation will improve the technology and reduce costs but must be coupled with additional policy support to increase market visibility and investor security and enable the further cost reductions that come with commissioning larger commercial plants.

- **Streamlined permitting and clear and coordinated processes across government.** Traditionally, the time from inception to completion can be 8–12 years, with 5–7 years for project development

67. Note that higher figures were also calculated based on coal displacement. These can be found in the full report (Hoegh-Guldberg et al. 2019).

68. Based on average emissions of 4.6 metric tons per year, according to EPA (2016).

## Box 9. Establishing Australia's First Offshore Wind Farm

Star of the South Wind Farm is Australia's first offshore wind farm, paving the way for a new sustainable ocean industry for Australia<sup>a</sup>. A joint development by Australia's Offshore Energy and Copenhagen Infrastructure Partners, Star of the South could include up to 250 turbines, with a combined capacity of up to 2 GW. This could supply about one-fifth of Victoria's power needs and, through close proximity to demand centres along the Australian coast, could minimise the need for battery storage normally associated with land-based wind and solar.

Following the grant of an exploration license in March 2019 to investigate the technical feasibility of constructing wind turbines in the ocean off the south coast of Gippsland, Victoria, Star of the South is moving forward with marine surveys and engineering options in terms of land-based grid connections. It has partnered with Curtin University and Deakin University to assist with offshore site investigations, focusing on understanding marine mammals in the project

area and undertaking the necessary seabird, seabed biodiversity and fish surveys. Both universities are working with RPS Australia Asia Pacific to collect data to inform the environmental assessments and the project's design. DHI has also joined the project by providing a 40-year hindcast of waves and currents that serves as input for moving further with the design phase (Skopljak 2020). Preliminary surveys also include mapping the seafloor, measuring water depths and identifying any buried infrastructure, such as cables.

In addition to the employment opportunities created through the above partnerships, the core development team for the project, all located locally in Melbourne, currently employs 35 people and is expected to grow to 50 by the end of 2020 (Parkinson 2020).

The Australian government has also begun developing a policy framework to underpin offshore wind development off its coasts, an initiative long called for by industry (Australian Government 2020a).

<sup>a</sup>For more information on the project, see <http://www.starofthesouth.com.au/>.

and 3–5 years for construction (Veum et al. 2011). Long lead times are caused by lengthy permitting requirements involving multiple agencies and lack of clarity of areas available for ocean-based renewable energy (considering competing users of the marine environment) (Crouse et al. 2018; UK Government 2016). Reducing these obstacles would send a clear signal of intent and regulatory certainty to industry and enable the acceleration of private sector investment in this industry. Note that streamlining of permitting does not include a fast track or elimination of the need for environmental impact assessments or community and stakeholder engagement and participation in the planning and citing process.

- **National targets and frameworks for ocean energy.** As part of the European Green Deal, the European Commission is currently developing its Offshore Renewable Energy Strategy, which will outline targets for between 250 and 450 GW of offshore renewable energy installed capacity by 2050, or capacity to meet

about 30 percent of Europe's energy demand (EU Commission 2020c). Achieving this target will require strong public-private partnerships and alignment with national climate policies, marine spatial planning policies and technology development frameworks. The United Kingdom has set a target for installed offshore wind energy of 40 GW by 2030; as part of this target the UK government will also be supporting the development of floating wind turbines. Germany has also approved the amendment to the Offshore Wind Act (WindSeeG) to reach 40 GW of offshore wind capacity by 2040.

- **Suitable financial support mechanisms (e.g. subsidies and guarantees) and revenue support to stimulate industry and avoid loss leaders.** A lack of financial support mechanisms (e.g. subsidies or guarantees), can drive up costs for industry and create roadblocks (Crouse et al. 2018; UK Government 2016). Governments could look to arrangements provided to stimulate early investment in land-based renewable energy, such as solar and wind subsidy schemes.



- **Investment in land-based grid updates and associated infrastructure.** The Netherlands government has published a roadmap for 2.5 GW of offshore wind by 2023 while also investing in a 700 MW offshore wind transformer platform to ensure that the land-based infrastructure is in place for private sector investment to support the achievement of the target.

### 3.3 Additional Opportunities for a Blue Transformation

As evidenced by the 2008–9 stimulus packages, not all investments will be directed at measures that create jobs in the short term. Instead, much of the investment will be used to lay the foundation for long-term recovery and resilience through systemic transitions to improve the efficiency and cost-effectiveness of our economy and by initiating large infrastructure projects that will yield benefits over the next 10 to 30 years.

Table 3 summarises a further set of opportunities for governments to consider to ensure a sustainable and equitable blue recovery from COVID-19 that will have long-lasting benefits for economic resilience and ocean health. These interventions, and their potential economic, social and environmental benefits, are detailed in full in Annex A.

These interventions are organised in three categories:

1. Research and development to spur innovation and new technology
2. Regulatory reform to provide an enabling environment for a sustainable ocean economy
3. Public-private partnerships for a blue transition

Just as on land, these investments have the potential to dramatically alter the course of a country's transition to a sustainable economy that can provide long-term economic opportunities, improved health and food security, reduced emissions, enhanced biodiversity and ecosystem services and improved resilience to climate impacts and other future shocks. For these additional opportunities, we sought ones that provided the following:

- Ability to build long-term resilience to future shocks (considering improving human, natural and physical capital) (Hammer and Hallegatte 2020; OECD 2020e)
- Ability to direct economic benefits to affected communities and vulnerable members of society (a people-centred approach) (UN 2020b)<sup>69</sup>
- Ability to catalyse progress towards a long-term sustainable and equitable blue economy (Hepburn et al. 2020)
- Ability to deliver on international commitments such as the 2030 Agenda for Sustainable Development and the Paris Agreement (IMF 2020b)
- Relevance to multiple regions and economies (OECD 2020e)

For each intervention, we identified the potential economic, social and environmental benefits based on existing literature. Note that for many of these interventions, no quantified benefits are yet available for the intervention level. The benefits highlighted are therefore intended to be a guide only and not prescriptive. As with any intervention, countries will need to go through a rigorous national process to fully quantify economic, social and environmental benefits given national or local circumstances.

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69. The UN secretary general has stressed the need to ensure that national and local response and recovery plans identify and put in place targeted measures to address the disproportionate impact of the virus on certain groups and individuals, including migrants, displaced persons and refugees, people living in poverty, those without access to water and sanitation or adequate housing, people with disabilities, women, older people, LGBTI people, children and people in detention or institutions.

**Table 3.** Additional Opportunities for a Blue Transformation

● Strong potential   ● Potential   ○ Minor potential

	SECTOR RELEVANCE	ECONOMIC BENEFITS	SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	SDGS
<b>RESEARCH AND DEVELOPMENT TO SPUR INNOVATION AND NEW TECHNOLOGY</b>					
Invest in research and development, including pilot projects, to accelerate the development of sustainable and low-carbon alternative feed options for fed mariculture (e.g. finfish).	Fisheries	●	●	●	2, 8, 9, 12, 13, 14
Invest in filling data gaps on national coastal and marine ecosystems through employment schemes for surveys, modelling and mapping.	Tourism, Fisheries	●	●	●	8, 12, 13, 14, 17
Invest in R&D and innovation grants to stimulate the development of new industries for generating alternative marine fuels, e.g. hydrogen and ammonia (invest in land-based infrastructure for fuel generation and supply chains as opposed to ship related investments).	Transport, Energy	●	○	●	7, 8, 9, 12, 13, 14, 17
Establish blue economy skills-training and capacity-development programs in key ocean industries for affected communities and industries (e.g. ocean-based renewable energy, zero-emission vessels, GIS, ecotourism, restoration).	Tourism, Fisheries, Energy, Transport, Marine Conservation	●	●	●	4, 7, 8, 9, 12, 13, 14, 17
Invest in research and development, including pilot projects, and incentivise emerging ocean-based renewables to accelerate their development.	Energy, Transport, Mariculture	●	●	●	7, 8, 9, 12, 13, 14



**Table 3.** Additional Opportunities for a Blue Transformation, continued

● Strong potential   ● Potential   ○ Minor potential

	SECTOR RELEVANCE	ECONOMIC BENEFITS	SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	SDGS
<b>REGULATORY REFORM TO PROVIDE AN ENABLING ENVIRONMENT FOR A SUSTAINABLE OCEAN ECONOMY</b>					
Establish comprehensive integrated ocean management and marine spatial planning processes to balance marine users and spaces, competition for coastal resources and mitigate permitting and siting issues for sustainable ocean industries.	Fisheries, Tourism, Energy, Shipping, Marine Conservation, Mariculture	●	●	●	8, 12, 13, 14, 17
Initiate regulatory reform to promote best practice in climate-adaptive fisheries management, including through incentives for industry adoption in the form of taxes and subsidies.	Fisheries	●	●	●	2, 8, 12, 13, 14
Shift harmful subsidies to more sustainable and equitable uses, including supporting small-scale and artisanal fishing, ecotourism opportunities for local communities and management and monitoring of marine protected areas.	Fisheries, Tourism, Marine Conservation	●	●	●	2, 8, 12, 14
Introduce levies or taxes to reinvest tourism revenue in local restoration and conservation efforts.	Tourism, Fisheries, Marine Conservation	●	●	●	8, 11, 12, 13, 14, 15
Integrate ocean accounts into national accounting frameworks, or develop satellite ocean accounts, to measure and monitor the impact of recovery measures on long-term sustainability of the ocean economy.	Fisheries, Tourism, Transport, Energy, Marine Conservation, Infrastructure	●	○	●	8, 9, 12, 13, 14, 17

**Table 3.** Additional Opportunities for a Blue Transformation, continued

● Strong potential ● Potential ○ Minor potential

	SECTOR RELEVANCE	ECONOMIC BENEFITS	SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	SDGS
<b>PUBLIC/PRIVATE PARTNERSHIPS FOR A BLUE TRANSITION</b>					
Mobilise private sector investment in hybrid ‘green/blue/grey’ approaches (e.g. utilising living coastal infrastructure in traditional construction) for coastal infrastructure projects and ports through financial incentives such as tax exemptions and guarantees.	Tourism, Fisheries, Marine Conservation	●	●	●	8, 9, 11, 13, 14, 15
Invest in port authorities to transition to ‘blue ports’ and port reception facilities.	Transport, Tourism, Energy, Infrastructure	●	●	●	3, 8, 9, 11, 13, 14, 17
Incentivise investment in cold storage capacity through access to affordable credit, government backed loans, duty-free imports of equipment and tax exemptions. <sup>a</sup>	Fisheries	●	●	●	2, 5, 8, 12, 14
Scale parametric insurance policies for blue natural capital in small island developing states, least developed countries and developing countries.	Tourism, Fisheries, Marine Conservation	●	○	●	11, 13, 14, 15, 17
Stimulate sustainable and environmental sensitive mariculture (e.g. integrated multi-trophic aquaculture) through financial incentives such as tax exemptions and affordable credit, and government-backed loans.	Fisheries, Mariculture	●	○	●	2, 8, 12, 13, 14



### 3.4 Opportunities for Blue Conditionality to Avoid Roll-Backs in Progress

The provision of immediate relief packages and grants to the private sector brings with it the opportunity to incentivise recipients to implement measures central to the sustainable ocean economy agenda—but which might have been harder to incentivise or promote before COVID-19 without such finance or might be vulnerable to roll-backs as a result of decreased traditional revenue streams.

Although any form of ‘blue condition’ could be attached to a debt-relief agreement or government grant, we highlight two particular opportunities that take advantage of emerging and innovative technologies to avoid roll-backs in progress:

1. Digitalisation of the fishing industry to promote sustainable fisheries management and end illegal, unreported and unregulated (IUU) fishing.
2. Disclosure of ocean data to inform decision-making.

The above measures represent opportunities to advance long-standing agendas in terms of improving marine biodiversity, enhancing monitoring, ensuring fish stock recovery and responding to climate change. Both of them will have significant long-term benefits, improving ecotourism opportunities, enhancing the value of existing coastal tourism and improving the economic viability of artisanal and commercial fisheries.

In the short term such arrangements can provide immediate economic relief to the recipients (through the grant) and potential cost savings for the government.

#### Sustainable fisheries management through digitisation

Conditions aimed at fisheries reform and digitisation of the fishing industry offer the opportunity to make progress on long-standing fisheries governance agendas while also overcoming many of the short-term impacts of COVID-19 restrictions and revenue losses. These include the loss of on-board observers and reduced capacity for marine patrols to monitor and track fishing vessels for the purposes of reducing overfishing and IUU fishing. Traditionally, the burden for gathering such data

has fallen on governments, but recovery efforts offer the opportunity to engage and empower the fishing industry itself to collect much of the data that underpin sustainable fisheries management.

The digitisation of the fishing industry would have other benefits in the face of COVID-19 and beyond fisheries governance. Traceability and data-sharing also enhances industry robustness and resilience by strengthening aquafeed supply chains, which have been curtailed during the COVID-19 crisis. Sharing data creates more robust supply chains for raw material. This can be achieved by making data on regional and sustainable raw materials sources available. Science-industry cooperation is vital for this process. Making these data available could also be a condition to strengthen the aquaculture industry (see the data-sharing and disclosure section below).

Consumers are also increasingly demanding more traceability, highlighting the added incentive for increased supply chain monitoring through digital tools. Creating alternative data-gathering mechanisms like apps empowers local fishers to take part in data-gathering while informing consumers. OurFish, developed by Rare, is one example of an app for local fishers to record and share their catch data digitally, creating a permanent digital log of sales, expenses and inventory. This app and the associated data also enable fishing communities to monitor the value, type and local amount of fish caught. The information can be made available to decision-makers in government and relevant stakeholder groups.

Examples of measures that could be attached to grants include requiring registration of vessels (relevant to small-scale and artisanal vessels); digital traceability—to increase transparency and strengthening monitoring, control and surveillance; and electronic monitoring and electronic

**Traceability and data-sharing also enhances industry robustness and resilience by strengthening aquafeed supply chains, which have been curtailed during the COVID-19 crisis.**



reporting. Conditions can also target the publication of essential data, including vessel ownership and licenses (see the data-sharing and disclosure section below).

These industry-led measures could be supplemented by government investment in new artificial intelligence-powered electronic monitoring systems, enhanced drones and satellite data interpreted by machine learning. Such efforts will also dramatically improve the fishing industry's resilience to similar future shocks.

The potential economic impact of such measures is significant. Globally, between 8 and 14 million metric tons of unreported catches are traded illicitly yearly, resulting in gross revenues of \$9 billion to \$17 billion associated with these catches. This equates to an estimated loss (in annual economic impact) of \$26 billion to \$50 billion globally, while losses to countries' tax revenues are between \$2 billion and \$4 billion (U.R. Sumaila et al. 2020). What this means for a region is significant. For example, the Pacific experiences an estimated loss in gross revenues to the formal economy of \$4.3 billion to \$8.3 billion per year. These losses are substantially higher when we consider the economic impact (\$10.8 billion to \$21.1 billion per year), income impact (\$2.8 billion to \$5.4 billion per year) and tax revenue impact (\$200 million–\$1.6 billion per year) (Konar et al. 2019a). Furthermore, as a result of potential illicit trade in seafood, workers in the sector lose an estimated \$6.8 billion to \$13.3 billion in income annually (U.R. Sumaila et al. 2020).

The results of moving to digital systems, including electronic monitoring and reporting, will significantly improve information. Fishery management systems currently rely heavily on data from fishers' daily logbooks that include locations, amount of time spent fishing, how many fish were caught and how many and what kind of fish or other species were discarded. On-board observers have been the only option to validate these logbook data, but such efforts only cover a tiny fraction of global fishing activities—likely less than 2 percent (Michelin et al. 2018). In most instances, electronic monitoring systems can achieve monitoring goals more cost-effectively than human observers and can more easily scale to cover 100 percent of fishing activity. Also, electronic monitoring can provide transparency in the

### **Box 10. Jamaica's Focus on Improving Traceability and Monitoring of Wild Capture Fisheries**

Jamaica's 17,000 artisanal fishers all received a one-time grant as part of Jamaica's initial rapid response to the impacts of COVID-19 on its fishing industry. These grants were to provide income support due to a drop in demand from Jamaica's tourist sector (the majority of Jamaica's fishing industry is oriented towards supplying high-end restaurants and resorts).

Jamaica has made long-standing efforts to restore its fish stocks through sustainable fisheries management and improved governance. The registration of artisanal fisherman has been a challenge.

Jamaica applied two main conditions to the grant: registration of the boat and mandatory GPS trackers. As a result of these conditions, Jamaica now has a much better understanding of the scale of small-scale fishing and has enabled a transition to digital information and tracking, two pillars of its existing commitment to sustainable fisheries management.

*Source: Government of Jamaica.*

critical first link in a supply chain that is traceable from supply to plate, giving consumers confidence when purchasing premium-priced seafood that is labelled as 'sustainably harvested' (for an example of how this is being done in Jamaica, see Box 10).

Unsustainable fishing practices, including IUU fishing, threaten local livelihoods, exacerbate poverty and heighten food insecurity. Seizing the opportunity of relief packages to address this issue will have long-term economic benefits for countries and regions, helping to improve the resilience of these communities and their fishing industries (local, artisanal and commercial) for decades to come.

## Improved transparency and decision-making through ocean data

Vast stores of unstructured data related to the ocean economy are currently stored by governments, researchers and industry (for legal, security or proprietary purposes), making them inaccessible and unusable to inform decision-making in either the public or private sector. These data should by default be made open and available through data-tagging, federated data networks (Brett et al. 2020). In support of SDG 14, the United Nations declared the 10-year period (2021–30) to be the UN Decade of Ocean Science for Sustainable Development (the Decade). The Decade is dedicated to providing a common framework to encourage stronger international cooperation that can better coordinate and integrate ocean data and research into the decision-making process of stakeholders.

Data on the ocean economy can spur incentives for innovation, new public-private instruments for investment and the creation of new business models as we adapt to our world's new realities after COVID-19. Increased data-sharing would also add resilience to ongoing COVID-19 challenges. Having active data streams is paramount for ocean resilience in facing up to COVID-19 and could contribute significantly to safer at-sea operations (e.g. through maritime track-and-trace systems using geofencing).

Conditions could include a requirement that private sector organisations and financial institutions disclose or improve the accessibility of such data. Such a condition would be comparable to those being advanced to improve environmental and climate disclosure as part of recovery packages (Office of the Prime Minister, Canada 2020).

Impactful requirements could include

- that all users of ocean resources such as fisheries, minerals, oil and gas or coastal land be required to make their environmental data available to the public (Leape et al. 2020);
- that domestic fisheries, fishing vessels, shipping and marine transport track their GHG emissions and report annually for inclusion in national GHG inventories in accordance with the relevant guidance of the Intergovernmental Panel on Climate Change;
- that fishing vessels use automatic identification systems and share essential data on fisheries, including vessel ownership, licenses and tracking for all fishing vessels (this is also relevant to fisheries reform, as identified above);
- that all data collected by defence and security agencies which can be shared without compromising national security be made publicly accessible (Leape et al. 2020); and
- that all financial institutions disclose whether their portfolios align with ocean sustainability. Companies based on, depending on or affecting the ocean should integrate relevant ocean-related risks and opportunities into corporate strategy, risk management and reporting<sup>70</sup>.

In addition to conditions placed on financial grants to the private sector, governments should also provide support and training to develop appropriate data-gathering and processing capacities and systems in developing countries and coastal communities, to ensure that these nations and communities are not left behind.

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70. See, for example, the ocean sustainability principles followed by Norges Bank Investment Management (2020).





# Conclusion

The importance of the ocean to a sustainable future is too important to neglect at this great moment of resetting and rebuilding. The relevance of the ocean for global economic and social recovery and future prosperity must become part of global discourse, and a greater part of measures applied to respond to the economic and social impacts of the crisis.



**A sustainable and equitable blue recovery is critical not just for those who live or work near the coasts but also for the well-being and resilience of societies and economies at large.**

The COVID-19 pandemic has severely impacted ocean industries and the livelihoods and food security of many millions of people. It has highlighted the significance of the ocean as a global workplace, its role in underpinning the modern economy and the inherent interdependencies between ocean sectors, the health of the ocean environment and human well-being.

How the world rebuilds from the COVID-19 crisis is of great importance for the ocean and climate. Early responses to promote economic recovery

and protect industries from further losses have included large-scale investments in sectors previously shown to be harmful to the environment, alongside the easing of environmental safeguards. Such measures risk the future health and wealth of the ocean economy with impacts for food security, livelihoods and our shared prosperity, rolling back progress made towards mitigating global biodiversity loss and climate change. Governments and financial institutions need to immediately strengthen efforts to build environmental, social and economic resilience.

In tailoring support for those most affected by the COVID-19 pandemic, greater attention must be paid to the ocean economy and its many direct and indirect beneficiaries. A sustainable and equitable blue recovery is critical not just for those who live or work near the coasts but also for the well-being and resilience of societies and economies at large.

This report has identified specific opportunities for the immediate investment of stimulus and recovery funds that would lead to a more sustainable and resilient ocean economy. It also has highlighted opportunities

to accelerate research on and development of future sustainable ocean industries and to transition emission- and pollution-intensive industries onto more sustainable pathways in order to reach their full economic growth potential.<sup>70</sup>

This report has highlighted that investment in the interventions necessary for a sustainable and equitable blue recovery will benefit other land-based sectors, including human health, technology, agriculture, supply chains and tourism.

The demonstrated interdependencies between the different ocean sectors, which has exacerbated the impacts of COVID-19 on individual industries, make a strong case for greater integration and collaboration among sectors, as a complement to traditional sectoral management, both in recovery efforts and long-term operations. Ecosystem-based, integrated ocean management and other related holistic and knowledge-based approaches to planning and managing the multitude of uses and users of ocean spaces offer an important framework to ensure that ocean industries can rebuild in a mutually reinforcing way towards a sustainable future ocean while protecting essential ocean ecosystems and functions.

This report highlights growing global inequalities and the need to accelerate equitable access to ocean opportunities and sharing of benefits from ocean industries. Response measures to support women, who have been disproportionately affected, notably in the tourism and fisheries sectors, will be particularly important to ensure access to decent work opportunities and the full engagement of women in ocean activities. There is also an ongoing need to improve working conditions for vulnerable 'key workers' at sea to better protect fishers and seafarers, who play an essential role in maintaining global supplies of food, medicines, energy and manufactured goods across supply chains.

To ensure a long-lasting economic recovery from the COVID-19 crisis, response measures must trigger investments and societal changes that reduce vulnerability and improve our collective resilience to future shocks (OECD 2020a). Recovery plans have so far

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70. See, for example, the ocean sustainability principles followed by Norges Bank Investment Management (2020)..



fallen short in this regard. To this end, governments must seize the opportunity of stimulus packages to address unsustainable fisheries practices, including IUU fishing, which undermines employment and livelihoods in one of the largest sectors of the ocean economy, exacerbates global poverty and risks the food security of over 3 billion people, including some of the world's poorest, who rely on the ocean as their primary source of protein. Technological advances introduced during COVID-19 and innovative financial mechanisms may hold the key to advancing such action.

The importance of the ocean to a sustainable future is too important to neglect at this great moment of resetting and rebuilding. The ocean's relevance for global economic and social recovery and future prosperity must become part of global discourse, and a greater part of measures applied to respond to the economic and social impacts of the COVID-19 crisis. The ocean-based or 'blue' investment opportunities detailed in this report offer a departure from business as usual in that they can deliver a more inclusive recovery, premised on a healthy and regenerative ocean to provide global benefits for the longer term.

Embracing a 'sustainable and equitable blue recovery' in the large stimulus packages being agreed worldwide can build ocean health and sustainability into recovery and support the transition towards a more sustainable, inclusive and resilient global economy.

# Annex A

**Table A1.** Research and Development to Spur Innovation and New Technology

INTERVENTIONS	SECTOR RELEVANCE	ECONOMIC BENEFITS
<p><b>Invest in research and development (R&amp;D), including pilot projects, to accelerate the development of sustainable and low-carbon alternative feed options for fed mariculture (e.g. finfish).</b></p>	<p>Fisheries</p>	<p>19.3 million people globally engaged in aquaculture (FAO 2018a).</p> <p>World food fish consumption in 2030 is projected to be 20% (or 30 million metric tons [MMT] live weight equivalent) higher than in 2016 (FAO 2018a).</p> <p>The major growth in production is expected to originate from aquaculture, which is projected to reach 109 MMT in 2030, with growth of 37% over 2016 (FAO 2018a).</p>



**Table A1.** Research and Development to Spur Innovation and New Technology, continued

SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	POTENTIAL FOR THE CREATION OF PERVERSE INCENTIVES	SDGS
<p>Improved health of local communities. A portion of 150 grams of fish provides about 50–60% of an adult’s daily protein requirement. Fish proteins are essential in the diet of some densely populated countries where the total protein intake is low, and they are particularly important in diets in small island developing states and least developed countries (FAO 2018a).</p> <p>Alternative feed innovations could ensure an additional 364 MMT of food annually—over six times current capture and mariculture production<sup>a</sup>. This is only possible if mariculture is not dependent on feed from fish products (Costello et al. 2019).</p> <p>Reduction in the diversion of forage fish from communities that rely on it for direct nutrition (Tacon and Metian 2008; Konar et al. 2019b) and protect the cultural value to Indigenous Peoples (Jones et al. 2017; Konar et al. 2019b).</p> <p>Innovations in feed technology could greatly enhance the potential for fed mariculture (Costello et al. 2019; Froehlich et al. 2018).</p> <p>Increasing ocean-based food (including aquaculture) will generate benefits nine times higher than costs (Konar and Ding 2020).</p> <p>Increased job creation through development of algae feed industry (Roberts and Upham 2012).</p>	<p>The global supply of fishmeal may be near biological limits (Costello et al. 2012).</p> <p>Improves resilience under climate change (Gaines et al. 2019).</p>	<p>Increase in pollution from aquaculture operations.</p> <p>Introduction of invasive species.</p> <p>Job loss from traditional feed sources.</p>	<p>1</p> <p>2</p> <p>3</p> <p>8</p> <p>12</p> <p>13</p> <p>14</p>

<sup>a</sup> Note that this figure is based on a tripling of global production of seafood for consumption, which would necessitate dramatic shifts in consumer taste and associated demand.

**Table A1.** Research and Development to Spur Innovation and New Technology, continued

INTERVENTIONS	SECTOR RELEVANCE	ECONOMIC BENEFITS
<p><b>Invest in filling data gaps on national coastal and marine ecosystems through employment schemes for surveys, modelling and mapping.</b></p>	<p>Tourism, Fisheries, Marine Conservation</p>	<p>Short-term job creation.</p> <p>Long-term economic efficiencies in terms of data availability.</p> <p>Potential access to carbon markets and associated on-going streams of revenue for management of ecosystems and local communities.</p>
<p><b>Invest in R&amp;D and innovation grants to stimulate the development of new industries for generating alternative marine fuels, such as hydrogen and ammonia (invest in land-based infrastructure for fuel generation and supply chains as opposed to ship-related investments).</b></p>	<p>Transport, Energy</p>	<p>Economic growth opportunity for export of low-cost hydrogen (utilising electrolyzers powered by renewable resources)<sup>b</sup> (IEA 2019) and green ammonia as a maritime fuel (Ash and Scarborough 2019).</p> <p>Economic diversification potential—energy storage, low-carbon heat, transport fuels and a key input in the production of fertiliser (ammonia) (Yara International 2019). Additional uses create synergies and reduce the investment risk, especially in the early phase of the transition (IEA 2020a).</p> <p>Job creation potential in many states and regions (Bezdek 2019). Widespread penetration could create nearly 1 million new jobs (highly skilled, well-paid technical and professional workers) in the United States by 2030 (ASEA and MIS 2009).</p>
<p><b>Establish blue economy skills training and capacity development programs in key ocean industries for affected communities and industries (e.g. ocean-based renewable energy, zero-emission vessels, geographic information systems, ecotourism, restoration).</b></p>	<p>Tourism, Fisheries, Energy, Transport, Marine Conservation</p>	<p>Economic benefits of local developments accrue locally (Gaines et al. 2019).</p> <p>Local investments in renewable energy and energy-efficient technologies can improve local livelihoods and enhance local economic benefits (Gaines et al. 2019).</p>

<sup>b</sup> Renewable hydrogen costs may fall to as low as \$1.40 a kilogram by 2030 from the current range of \$2.50 to \$6.80, with further reductions to 80 cents by 2050, equivalent to a natural gas price of \$6 per million British thermal units (Mathis and Thornhill 2019).

**Table A1.** Research and Development to Spur Innovation and New Technology, continued

SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	POTENTIAL FOR THE CREATION OF PERVERSE INCENTIVES	SDGS
<p>Increased participation in ‘citizen science’ can encourage public action and improve conservation efforts (McKinley et al. 2017).</p> <p>Sustained ocean observations benefit many users and societal goals across society actors (Weller et al. 2019).</p> <p>Community ownership and understanding of natural resources.</p>	<p>Improved understanding and mapping of ecosystem extent and species diversity.</p> <p>Basis for inclusion of ecosystems in national greenhouse gas (GHG) inventories to enable mitigation for blue carbon ecosystems (mangroves, seagrass and salt marshes), and important for monitoring adaptation benefits from other marine habitats like coral reefs.</p> <p>Increased management capabilities.</p>		<p>8</p> <p>13</p> <p>14</p>
<p>Diversified economic opportunities for local communities.</p>	<p>Reduced GHG emissions.</p> <p>Improved air quality (based on reduced reliance on fossil fuels as a result of green fuels).</p> <p>Improved water quality, including deep-sea routes.</p>		<p>7</p> <p>8</p> <p>9</p> <p>12</p> <p>13</p> <p>14</p>
<p>Diversified economic opportunities for local communities.</p> <p>Local capacity building in ecotourism (foundation for ensuring revenue is reinvested in the local community).</p> <p>Increased cultural awareness by sharing traditional knowledge.</p> <p>Increased community buy-in.</p>	<p>Reduced emissions.</p> <p>Improved monitoring and protection of marine protected areas and coastal and marine ecosystems.</p> <p>Using ecotourism for conservation through programs like sea turtle watch or citizen science.</p>		<p>7</p> <p>8</p> <p>9</p> <p>12</p> <p>13</p> <p>14</p>



**Table A1.** Research and Development to Spur Innovation and New Technology, continued

INTERVENTIONS	SECTOR RELEVANCE	ECONOMIC BENEFITS
<p><b>Invest in research and development, including pilot projects, and incentivise emerging ocean-based renewables to accelerate their development.</b></p>	<p>Energy, Transport, Mariculture</p>	<p>The global market of wave and tidal sectors is estimated to reach €53 billion per year by 2050 (Carbon Trust 2011).</p>

**Table A1.** Research and Development to Spur Innovation and New Technology, continued

SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	POTENTIAL FOR THE CREATION OF PERVERSE INCENTIVES	SDGS
<p>Ocean-based renewable energy has the potential to generate 400,000 jobs in Europe by deploying 100 GW by 2050 (ETIP Ocean 2020). The global deployment is estimated to be 337 GW (OES 2011), which indicates that ocean energy will generate about 1.2 million jobs globally by 2050.</p>	<p>Ocean-based renewable energy can reduce GHG emissions by between 0.05 and 0.87 GtCO<sub>2</sub>e/year by 2050 (Hoegh-Guldberg et al. 2019). It can also create marine reserves and artificial reefs (Copping et al. 2016).</p>		<p>7</p> <p>8</p> <p>9</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p>

**Table A2.** Regulatory Reform to Provide an Enabling Environment for a Sustainable Ocean Economy

INTERVENTIONS	SECTOR RELEVANCE	ECONOMIC BENEFITS
<p><b>Establish comprehensive integrated ocean management and marine spatial planning processes to balance marine users and spaces, reduce competition for coastal resources and mitigate permitting and siting issues for sustainable ocean industries.</b></p>	<p>Fisheries, Tourism, Energy, Shipping, Marine Conservation, Mariculture</p>	<p>Potential economic growth and new economic opportunities (European Commission 2020a). Sector growth facilitated through improved framework (Jay 2017). Cost reduction through streamlining regulatory and compliance processes (European Commission 2020a).</p>
<p><b>Initiate regulatory reform to promote best practice in climate adaptive fisheries management, including through incentives for industry adoption in the form of taxes and subsidies.</b></p>	<p>Fisheries</p>	<p>More catch and profits through climate-adaptive management than through business-as-usual management (Free et al. 2019). Economic diversification through providing a portfolio of options to fishers and a buffer against climate-driven losses in any one target stock (Free et al. 2019). Economic losses of about US\$83 billion in 2012, compared with the optimal global maximum economic yield equilibrium (World Bank 2017).</p>
<p><b>Shift harmful subsidies to more sustainable and equitable uses, including supporting small-scale and artisanal fishing industry, ecotourism opportunities for local communities and management and monitoring of MPAs.</b></p>	<p>Fisheries, Tourism, Marine Conservation</p>	<p>6.3% of global GDP (\$4.7 trillion) was provided as fossil fuel subsidies in 2015, including uninternalised externalities (Coady et al. 2019). About \$35 billion in subsidies are allocated to global marine fisheries alone each year, of which \$22 billion are allotted to harmful subsidies (R.U. Sumaila et al. 2019). New economic opportunities for local communities through ecotourism. Job protection (or creation) for local communities in MPA management and monitoring. The World Bank has estimated that reducing global fisheries overexploitation, of which subsidies are key factor, could generate an additional \$53 billion to \$83 billion in revenue annually (World Bank 2017).</p>

**Table A2.** Regulatory Reform to Provide an Enabling Environment for a Sustainable Ocean Economy, continued

SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	POTENTIAL FOR THE CREATION OF PERVERSE INCENTIVES	SDGS
<p>Reduced conflict through improved stakeholder relations and engagement (European Commission 2020a).</p> <p>Inclusivity and recognition of Indigenous rights such as the Beaufort Sea Partnership in Canada, which works with the local Indigenous groups.</p>	<p>Streamlined management resulting in more effective governance to mitigate environmental risks posed by ocean-based activities and industries.</p> <p>Increased stock through improved management.</p> <p>Improved conservation of coastal and marine habitats.</p>	<p>Lobbying for greater influence and industry capture.</p>	<p>1</p> <p>2</p> <p>8</p> <p>12</p> <p>13</p> <p>14</p> <p>17</p>
<p>Local and community-based management can increase adaptive capacity by incorporating local knowledge and can improve sustainability by fostering a sense of stewardship (Gutiérrez et al. 2011).</p> <p>These strategies also allow fishers to generate revenues through other compatible activities, such as tourism, recreation and aquaculture (Moreno and Revenga 2014).</p>	<p>Ecological resilience through maintaining healthy stock sizes, age structures and genetic diversity (Free et al. 2019).</p> <p>Reduced impacts of climate change on fish stocks (Free et al. 2019).</p> <p>Thanks in part to adaptive harvest strategies fish stocks not fished beyond their biological limit and overfished stocks allowed to rebuild (Melnichuk et al. 2014).</p>	<p>Overfishing or stock decline if not linked to science.</p>	<p>2</p> <p>8</p> <p>12</p> <p>13</p> <p>14</p>
<p>Subsidies that are disproportionately provided to the large industrial fishing sub-sector serve to undermine the Sustainable Development Goals by aggravating hunger, poverty and gender inequality in coastal communities worldwide (R.U. Sumaila 2020).</p> <p>Redirected subsidies could be used to improve gender equality by empowering female fishers (Österblom et al. 2020).</p> <p>Redirected subsidies could support Indigenous Peoples and local communities, many of which practice artisanal fishing, as well as the conservation and sustainable use of marine biological diversity.</p>	<p>Improved biodiversity outcomes if redirected subsidies are used to fund jobs in monitoring of protected areas.</p> <p>Improved fish stocks if redirected subsidies are used to fund incentives to improve traceability of fisheries, inclusion of women and jobs on coastal restoration works (R.U. Sumaila 2020).</p>	<p>Mismanagement of funds.</p>	<p>1</p> <p>2</p> <p>5</p> <p>7</p> <p>8</p> <p>10</p> <p>12</p> <p>14</p>

**Table A2.** Regulatory Reform to Provide an Enabling Environment for a Sustainable Ocean Economy, continued

INTERVENTIONS	SECTOR RELEVANCE	ECONOMIC BENEFITS
<p><b>Introduce levies and taxes to reinvest tourism revenue in local restoration and conservation efforts.</b></p>	<p>Tourism, Fisheries, Marine Conservation</p>	<p>Additional revenue stream.</p> <p>Iceland’s Tourist Site Protection Fund promotes the development, maintenance and protection of tourism attractions and is funded by Iceland’s accommodations tax, enacted in 2011 (OECD 2018).</p> <p>Reduction of value-added tax on tourism-related goods and services in Ireland was followed by an increase in employment through growth in numbers of tourists (OECD 2014).</p>
<p><b>Integrate ocean accounts into national accounting frameworks, or develop satellite ocean accounts, to measure and monitor the impact of recovery measures on long-term sustainability of the ocean economy.</b></p>	<p>Fisheries, Tourism, Transport, Energy, Marine Conservation, Infrastructure</p>	<p>Digital solutions are important to facilitate, among other things, enhanced reporting of crisis-related spending, ex post audits and procurement transparency (IMF 2020c).</p> <p>By tracking each budget transaction across government agencies, accounts can produce timely, reliable, accurate and meaningful information to support financial decision-making, improve fiscal discipline, strengthen expenditure control and enhance fiscal transparency (Uña et al. 2019).</p>



**Table A2.** Regulatory Reform to Provide an Enabling Environment for a Sustainable Ocean Economy, continued

SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	POTENTIAL FOR THE CREATION OF PERVERSE INCENTIVES	SDGS
<p>Reinvestment in jobs for local communities (should be done in coordination with local communities, including Indigenous Peoples, local communities and women affected by conservation efforts, to ensure buy-in).</p>	<p>Proceeds from taxes and levies secure funding for the protection of environmental areas.</p> <p>In Australia, the Great Barrier Reef Marine Park Environmental Management Charge proceeds are applied directly to the management of the marine park, including through education, research, compliance patrols, site planning, public moorings, reef protection markers, information signs and maps (OECD 2014).</p>	<p>Mismanagement of funds.</p> <p>Tourism can harm local ecosystems.</p>	<p>8</p> <p>11</p> <p>13</p> <p>14</p>
<p>Data and improved metrics to track equitable distribution of ocean wealth.</p>	<p>Data to account for natural wealth.</p> <p>Integration of ecosystem services into decision-making.</p>		<p>8</p> <p>9</p> <p>12</p> <p>14</p> <p>16</p> <p>17</p>

**Table A3.** Public/Private Partnerships for a Blue Transition

INTERVENTIONS	SECTOR RELEVANCE	ECONOMIC BENEFITS
<p><b>Mobilise private sector investment in hybrid ‘green/blue/grey’ approaches (e.g. utilising living coastal infrastructure in traditional construction) for coastal infrastructure projects and ports through financial incentives such as tax exemptions and guarantees.</b></p>	<p>Tourism, Fisheries, Marine Conservation</p>	<p>Natural coastal barriers, such as mangroves, wetlands and sandbars, lower costs for grey infrastructure, such as seawalls, sea dikes and groynes. New York City saved 22%, or \$1.5 billion, by combining green and grey infrastructure instead of pursuing a grey-only strategy to secure water supply for the city (Bloomberg and Holloway 2018).</p> <p>In Vietnam, an investment of \$9 million to restore 9,000 hectares of mangroves along the shores of 166 communes as well as 100 kilometres of dike lines cut the cost of damages by \$80,000–\$295,000 and saved an additional \$15 million in avoided damages to private property and other public infrastructure (IFRC 2011).</p> <p>Increased ecotourism opportunities in living infrastructure (e.g. mangroves and wetlands).</p>
<p><b>Invest in port authorities to transition to ‘blue ports’ and port reception facilities.<sup>a</sup></b></p>	<p>Transport, Tourism, Energy, Infrastructure</p>	<p>Low-emission and fuel-efficient terminal equipment will save money through reduced energy consumption.</p> <p>Increased efficiency through improved equipment will reduce operation costs.</p> <p>Increased investment from offshore wind tenants who may be dealing with outdated port ownership structures and inexperienced owners.</p> <p>Synergies with zero-emission vessels and energy production.</p> <p>Identify technical and operational innovations to reduce the high transportation costs that exist for many developing countries and other remote locations (UNGC 2020b).</p> <p>Incorporate climate change adaptation considerations into ‘blue ports’, as ports are at increasing risk of coastal flooding. Infrastructure inventories, higher resolution data, as well as technologies that help improve the understanding of coastal processes under climate change are needed for effective risk-assessment and adaptation planning for critical transport infrastructure, particularly in small island developing states (UNCTAD 2020c).</p>

<sup>a</sup> ‘Blue ports’ are considered to be sustainable, support the transition to decarbonised marine transport and shipping fleets through fuel supply chains, promote transparency and traceability for fisheries and utilise nature-based solutions.

**Table A3.** Public/Private Partnerships for a Blue Transition, continued

SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	POTENTIAL FOR THE CREATION OF PERVERSE INCENTIVES	SDGS
<p>Catastrophic risk reduction for loss of life in storm surges through reducing wave energy and the height of a storm surge (Beck and Lange 2016).</p> <p>Main operators of green infrastructure are often local communities, responsible for implementing land stewardship practices and for maintaining the project over the long term (unlike grey infrastructure that is operated and owned by a company or government entity) (Browder et al. 2019).</p>	<p>Climate-mitigation potential (depending on ecosystem).</p> <p>Coastal resilience through reduced storm surges and protection of coastal communities and infrastructure from sea level rise.</p> <p>Improved biodiversity, water quality, watershed protection (Browder et al. 2019).</p>		<p>8</p> <p>9</p> <p>11</p> <p>13</p> <p>14</p> <p>15</p>
<p>Improved air quality.</p> <p>Improved health and livelihood of people working or living around ports and the ‘liveability’ of the area surrounding the port.</p> <p>Opportunities for gender equity in access to resources, services, markets, incomes and employment (FAO 2018b).</p>	<p>Responsible fisheries management.</p> <p>Reduction of shoreside idling (Sharma 2016) by providing shoreside power will reduce noise pollution (NoMEPorts 2008), improve air quality and reduce fuel consumption.</p> <p>Reduced waste pollution through improved solid waste handling and recycling programs at port (Svaetichin and Inkinen 2017).</p>	<p>Added ecosystem disturbance through updates.</p>	<p>3</p> <p>8</p> <p>9</p> <p>11</p> <p>13</p> <p>14</p> <p>15</p> <p>17</p>

**Table A3.** Public/Private Partnerships for a Blue Transition, continued

INTERVENTIONS	SECTOR RELEVANCE	ECONOMIC BENEFITS
<p><b>Incentivise investment in cold storage capacity through access to affordable credit, government-backed loans, duty-free imports of equipment and tax exemptions<sup>b</sup>.</b></p>	<p>Fisheries</p>	<p>Live, fresh or chilled is the preferred and highest-priced form of fish and represents the largest share of fish for direct human consumption (FAO 2018a).</p> <p>Resilience to future shocks. Increased demand for frozen fish since outbreak of COVID-19 (Saumweber et al. 2020).</p> <p>Increased yields for fishers.</p> <p>Increased income for fishers as a result of high-quality fish.</p> <p>Marine exports grew by 7.68% in the fiscal year following an investment package by the Government of India, which included ongoing subsidies to build large cold storages for surplus seafood<sup>c</sup> (Narayanswami and Balan 2013).</p>
<p><b>Scale parametric insurance policies for blue natural capital in SIDS, LDCs and developing countries.</b></p>	<p>Tourism, Fisheries, Marine Conservation</p>	<p>100 metres of mangrove barrier can reduce wave heights by two-thirds.</p> <p>Building oyster reefs adjacent to shore in the United States can reduce the cost of every metre of coastal protection by over \$750, compared to other engineering options (Spalding et al. 2016).</p> <p>In France, the Caisse Centrale de Réassurance has estimated that insured property damages will rise by 50% if no preventive measures for climate change-related effects are implemented (CCR 2018).</p> <p>Marine ecosystems represent natural capital and non-market flows and services. Healthy coral barriers stop the damaging effects of hurricanes and cyclones hitting the coasts.</p> <p>The value of marine ecosystems, based on the total bundle of ecosystem services provided by an ‘average’ hectare of open ocean, is estimated at \$490/year, while the value of services provided by an ‘average’ hectare of coral reefs is almost \$350,000/year (OECD 2016).</p>
<p><b>Stimulate sustainable and environmentally sensitive mariculture (e.g. integrated multi-trophic aquaculture [IMTA]) through financial incentives such as tax exemptions and affordable credit, as well as through government-backed loans.</b></p>	<p>Fisheries, Mariculture</p>	<p>Economic diversification.</p> <p>Increased profitability per cultivation unit and higher income (Troell et al. 2009).</p> <p>Resilience to shock and market changes through product diversification. Increased yields. At sites in Canada’s Bay of Fundy, growth rates of kelp and mussels cultured in proximity to fish farms were found to be 46% and 50% higher, respectively, than at control sites (Chopin et al. 2004).</p>

<sup>b</sup> Any investment in cold storage by the private sector must be coupled with public investment in the supporting supply chain infrastructure. Governments should also eliminate disincentives to cold storage (such as taxes on foreign refrigeration systems) (FAO 2020b).

<sup>c</sup> Other measures included the government’s exempting air-conditioning equipment and refrigeration panels used in cold chain from excise duties and allowing duty-free import of refrigerated units used in reefer trucks (Narayanswami and Balan 2013).

<sup>d</sup> In all modelling scenarios, the decrease in the food loss and waste carbon footprint from cold chain expansion clearly outweighs the newly created emissions, by a factor of 10, approximately (GFCCC 2015).

**Table A3.** Public/Private Partnerships for a Blue Transition, continued

SOCIAL BENEFITS	ENVIRONMENTAL BENEFITS	POTENTIAL FOR THE CREATION OF PERVERSE INCENTIVES	SDGS
<p>Loss or waste between landing and consumption due to a lack of refrigeration still accounts for an estimated 27% of total catch, representing a missed opportunity in terms of additional protein available for local communities and consumers (FAO 2018a; NoMEPorts 2008).</p> <p>Shifting to freezing could have a positive impact on women’s employment, as they constitute a high proportion of workers in the post-harvest/food processing sector (UNCTAD 2020b).</p>	<p>Analysis has shown a net benefit in GHG emissions reduction from expanding cold storage to developing countries. In all modelling scenarios, decreased emissions from food loss and waste from cold chain expansion outpaced newly created emissions from the expansion and use of cold storage, by a factor of 10, approximately<sup>d</sup>.</p>	<p>Fishers may be incentivised to fish further offshore or more intensely because they can now store food longer.</p>	<p>2</p> <p>5</p> <p>12</p> <p>13</p> <p>14</p>
<p>Climate risk reduction measures to ensure insurance coverage for previously non-insurable situations like sea level rise and other slow-onset events.</p>	<p>Coastal resilience through reduced storm surges and protection from sea level rise.</p> <p>Improved biodiversity, water quality, watershed protection (Browder et al. 2019).</p>		<p>11</p> <p>13</p> <p>14</p> <p>15</p>
<p>Source of employment for local communities.</p> <p>Increased protein yields.</p> <p>Opportunities for regional collaboration. The Yellow Sea Large Marine Ecosystem Project, established under the guidance of the Global Environment Facility and the UN Development Programme, and in a partnership between China and South Korea, is working to implement IMTA in the region.</p>	<p>Preservation of local habitats.</p> <p>Recycling of waste nutrients and bio-mitigation typically produced through traditional mariculture by lower trophic level crops (Troell et al. 2009).</p>		<p>2</p> <p>8</p> <p>12</p> <p>13</p> <p>14</p>



# Annex B

**Table B1.** Additional Reference Materials on a Sustainable Ocean Economy

AUTHOR	REPORT	SUMMARY
<b>SUSTAINABLE OCEAN ECONOMY REPORTS</b>		
UNGC, 2020	<i>Ocean Stewardship 2030</i>	This report offers a roadmap for how ocean-related industries and policymakers can jointly secure a healthy and productive ocean by 2030. The report describes five critical areas of success. For each area, the report suggests two ambitions and puts forward several recommendations addressing critical dimensions of public and private actions to accelerate ocean-related solutions.
European Commission, 2020	<i>The EU Blue Economy Report</i>	This report highlights the need to preserve marine ecosystems to optimise potential benefits of ecosystem services and marine and maritime economic sectors.
European Parliamentary Research Service, 2020	<i>The Blue Economy: Overview and EU Policy Framework</i>	This report looks into the EU policy framework and the different EU initiatives and actions taken in these areas, both by providing an overview of the cross-cutting 'key enablers' of the blue economy and by providing an analysis by blue economy sector (excluding the sectors of coastal protection and maritime defence).
Konrad Adenauer Stiftung/FICCI, 2019	<i>Blue Economy: Global Best Practices Takeaways for India and Partner Nations</i>	This report systematically examines and explains the performance, projected growth in terms of size and value, challenges and precise opportunities for capacity expansion and quality enhancement, including technology and process upgrades, in the relevant sectors of India's blue economy. The report also elaborates the global best practices relevant to India as well as innovative financing tools. The report makes several practical recommendations for an effective way forward, both for the government and businesses.
OECD, 2019	<i>Rethinking Innovation for a Sustainable Ocean Economy</i>	This report on the ocean economy emphasises the growing importance of science and technologies in improving the sustainable economic development of our seas and ocean.
World Bank, 2019	<i>Indonesia Economic Quarterly: Oceans of Opportunity</i>	This report discusses the importance of the maritime economy to Indonesia's economic development and presents the challenges and opportunities the country faces in leveraging the maritime economy for greater prosperity.
Africa Institute of South Africa, 2018	<i>The Blue Economy Handbook of the Indian Ocean Region</i>	This handbook offers insight into the various aspects and impacts of the blue economy in the Indian Ocean region. From shifting paradigms, to an accounting framework, gender dynamics, the law of the sea and renewable energy, it aims to increase awareness of the blue economy in this region and to provide evidence to help policymakers in the region make informed decisions.
World Bank Group, UN DESA, 2017	<i>The Potential of the Blue Economy: Increasing Long-Term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least-Developed Countries</i>	Drafted by a working group of UN entities, the World Bank and other stakeholders, this report offers a common understanding of the blue economy. It seeks to highlight the importance of such an approach, particularly for small island developing states and coastal least developed countries; to identify some of the key challenges posed by adoption of the blue economy; and to suggest some broad next steps that are called for in order to ensure its implementation.

**Table B1.** Additional Reference Materials on a Sustainable Ocean Economy, continued

AUTHOR	REPORT	SUMMARY
<b>SUSTAINABLE OCEAN ECONOMY REPORTS</b>		
WWF, 2017	<i>Reviving the Western Indian Ocean Economy: Actions for a Sustainable Future</i>	This report aims to help Western Indian Ocean countries achieve the Sustainable Development Goal plan of action for 2016–30 in the ocean sector and thus realise the vision, expressed under the regional strategic action programme, of ‘people prospering from a healthy Western Indian Ocean’.
Commonwealth Secretariat, 2016	<i>The Blue Economy and Small States</i> (Commonwealth Blue Economy Series, no. 1)	The Commonwealth Blue Economy Series presents a synthesis of information and practical advice to Commonwealth governments relating to the potential deployment of a range of policy options for different sectors and opportunities for the road ahead. In so doing, this series aims to support the development of the blue economy in Commonwealth countries by providing a high-level assessment of the opportunities available for economic diversification and sustainable growth.
Global Ocean Commission, 2016	<i>The Future of Our Ocean: Next Steps and Priorities</i>	To accelerate progress towards reversing ocean degradation and drive the global system for ocean governance, the Global Ocean Commission calls upon UN member states and all relevant stakeholders to agree a stand-alone Sustainable Development Goal (SDG) for the global ocean, thus putting the global ocean front and centre on the post-2015 UN development agenda.
OECD, 2016	<i>The Ocean Economy in 2030</i>	This report explores the growth prospects for the ocean economy, its capacity for future employment creation and innovation, and its role in addressing global challenges. Special attention is devoted to the emerging ocean-based industries in light of their high growth and innovation potential, and their possible contribution to addressing challenges such as energy security, environment, climate change and food security.
World Bank, 2016	<i>Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean</i>	This report serves as a guide to help Caribbean policymakers plan a successful transition to a blue economy and to socially equitable ‘blue growth’. This report attempts to quantify the current value of the ocean economy in the region and to summarise projections about where we may find new pockets of sustainable growth.
UNEP, 2015	<i>Blue Economy: Sharing Success Stories to Inspire Change</i>	This report shares stories that illustrate how economic indicators and development strategies can better reflect the true value of such widespread benefits and potentially even build on them.
WWF, 2015	<i>Reviving the Ocean Economy: The Case for Action</i>	This report analyses the ocean’s role as an economic powerhouse and outlines the threats that are pushing it toward collapse. This report presents an eight-point action plan that would restore ocean resources to their full potential.
WWF, 2015	<i>Living Blue Planet</i>	This report provides a science-based analysis of the health of our planet and the impact of human activity upon it.
California Environmental Associates, 2015	<i>Ocean Prosperity Roadmap: Fisheries and Beyond</i>	This report collects research designed to inform decision-makers, including governments and investors, about effective ocean and coastal resource management strategies to maximise economic, conservation and societal benefits.

**Table B1.** Additional Reference Materials on a Sustainable Ocean Economy, continued

AUTHOR	REPORT	SUMMARY
<b>SUSTAINABLE OCEAN ECONOMY REPORTS</b>		
Global Ocean Commission, 2014	<i>From Decline to Recovery: A Rescue Package for the Global Ocean</i>	This report outlines a set of eight practical proposals to address the five drivers of decline, reverse high seas degradation and improve the system of governance, monitoring and compliance.
UNCTAD, 2014	<i>The Oceans Economy: Opportunities and Challenges for Small Island Developing States</i>	This report is a joint effort by a team of experts from the UN Conference on Trade and Development and the Commonwealth Secretariat to better understand the implications of the nascent and evolving concept of the ocean economy. It underlines the importance of sustainable oceanic activities for the development of small island developing states (SIDS) and other coastal states. The report identifies both opportunities and challenges for SIDS in existing and emerging trade-related sectors such as sustainable fisheries and aquaculture, ocean-based renewable energy, marine bio-prospecting, maritime transport and marine and coastal tourism.
Blue Ribbon Panel, 2013	<i>Indispensable Ocean: Aligning Ocean Health and Human Well-Being</i>	This report by the Blue Ribbon Panel (composed of 21 global leaders in government, industry, conservation and academia) identifies five high-level principles to guide the selection and prioritisation of initiatives aimed at aligning ocean health and human well-being.
UNEP, 2012	<i>Green Economy in a Blue World: Synthesis Report</i>	This report analyses how key sectors that are interlinked with the marine and coastal environment can make the transition towards a green economy. It covers the impacts and opportunities linked with shipping and fisheries to tourism, marine-based renewable energies and agriculture.
<b>SECTOR-SPECIFIC</b>		
UNCTAD, 2019	'Advancing Sustainable Development Goal 14: Sustainable Fish and Seafood Value Chains, Trade and Climate'	This background note reviews current trends and projections of fish and seafood trade, and recent work undertaken to support implementation of the trade-related activities of SDG 14, with a focus on the work of UNCTAD, FAO and UN Environment.
World Bank, 2017	<i>The Sunken Billions Revisited: Progress and Challenges in Global Marine Fisheries</i>	This report builds on <i>The Sunken Billions: The Economic Justification for Fisheries Reform</i> , a 2009 study published by the World Bank and the Food and Agriculture Organization of the United Nations, but with a deeper regional analysis.
Commonwealth Secretariat, 2016	<i>Capture Fisheries</i> (Commonwealth Blue Economy Series, no. 3)	This report presents recommendations that could be implemented by small island developing states (SIDS) to protect and sustainably develop their capture fisheries within a blue economy model. The report describes some of the challenges faced in managing capture fisheries, the potential for a blue economy approach to making improvements, some suggestions for strategies and activities that could be undertaken by SIDS to further these aims and a number of case studies illustrating positive actions that have been taken by SIDS and their outcomes.
FAO, 2014	<i>Global Blue Growth Initiative and Small Island Developing States (SIDS)</i>	This report identifies fish and fisheries as the mainstay of food security and the wealth of most small island developing states (SIDS). Many SIDS are heavily dependent on their oceanic and coastal fisheries resources for economic growth and development, as well as food security and livelihoods, and are vulnerable to any change in the state of these resources.

**Table B1.** Additional Reference Materials on a Sustainable Ocean Economy, continued

AUTHOR	REPORT	SUMMARY
<b>AQUACULTURE</b>		
UNGC, 2020	<i>Seaweed Manifesto</i>	This report defines a vision for an upscaled, responsible and restorative seaweed industry, playing a globally significant role in food security, climate change mitigation and support of the marine ecosystem, as well as contributing to job creation and poverty alleviation. The Seaweed Manifesto explores the challenges and barriers to responsible development of the industry.
TNC, 2019	<i>Towards a Blue Revolution: Catalyzing Private Investment in Sustainable Aquaculture Production Systems</i>	This report seeks to articulate the full scale and potential of the aquaculture sector to catalyse investment in projects and companies that can deliver targeted financial returns and improved environmental performance over business-as-usual production.
FOA, 2018	'Achieving Blue Growth'	This paper presents the Blue Growth Initiative and the three pillars of sustainable development—social, economic and environmental—that can enable fisheries and aquaculture to contribute to the 2030 Agenda’s Sustainable Development Goals. The Blue Growth Initiative is a strategic approach to improving the use of aquatic resources and achieving better social, economic and environmental outcomes.
Commonwealth Secretariat, 2016	<i>Aquaculture</i> (Commonwealth Blue Economy Series, no. 2)	This volume explores the potential for the development of a blue economy mariculture industry, as well as specific enabling conditions for economic opportunity.
FOA, 2015	<i>Fisheries and Aquaculture in the Context of Blue Economy</i>	This report looks at the current situation of fisheries and aquaculture in the context of the blue economy or blue growth and its relevance for African coastal countries.
World Bank, 2013	<i>Fish to 2030: Prospects for Fisheries and Aquaculture</i>	This report presents global prospects for fisheries and aquaculture and analyses future trends out to 2030.
<b>TOURISM</b>		
IDDRI, 2019	<i>Sustainable Blue Tourism</i>	This report explores the ecological impacts of coastal and marine tourism in the Mediterranean, the Caribbean, the Northeast Atlantic, the South Pacific Ocean and the Western Indian Ocean, the major global marine regions, in order to disseminate lessons from the field and develop common policy recommendations for policymakers, tourism stakeholders and other relevant institutional and civil society actors.
UNWTO, 2016	<i>Sustainable Cruise Tourism Development Strategies: Tackling the Challenges in Itinerary Design in South-East Asia</i>	This report issues a call to action at a critical juncture in Southeast Asian development. It seeks to further awareness of sustainable development in cruise tourism, catalyse collaboration across the region and stimulate the strategic implementation of best practices and innovations.

**Table B1.** Additional Reference Materials on a Sustainable Ocean Economy, continued

AUTHOR	REPORT	SUMMARY
<b>TOURISM</b>		
EU Commission, 2016	<i>Study on Specific Challenges for a Sustainable Development of Coastal and Maritime Tourism in Europe</i>	This report first presents the findings on specific challenges and innovative response strategies for sustainable development of coastal and maritime tourism, including challenges related to island connectivity (Part A) and innovative practices for marina development (Part B). It then presents findings related to innovative strategies for a more competitive nautical tourism sector, including marina development.
UNWTO, 2013	<i>Sustainable Tourism Governance and Management in Coastal Areas of Africa</i>	This report presents the results of the research carried out within the framework of the Collaborative Actions for Sustainable Tourism (COAST) project. It builds on Making Tourism More Sustainable: A Guide for Policy Makers, published by the UN World Tourism Organization and UN Environment, assessing how to apply sustainability principles and policy instruments for coastal tourism development in Africa.
<b>SHIPPING</b>		
IRENA, 2019	<i>Navigating the Way to a Renewable Future: Solutions to Decarbonise Shipping</i>	This report explores the impact of maritime shipping on CO2 emissions, the structure of the shipping sector and key areas that need to be addressed to reduce the sector's carbon footprint.
UK Department of Transportation, 2019	<i>Reducing the Maritime Sector's Contribution to Climate Change and Air Pollution</i>	This report provides a framework for assessing current and future economic opportunities in the design, development and commercialisation of technologies and low-emission fuels to reduce UK shipping emissions.
EU Commission, Directorate-General for Mobility and Transport, 2017	<i>Study on Differentiated Port Infrastructure Charges to Promote Environmentally Friendly Maritime Transport Activities and Sustainable Transportation</i>	This study assesses existing schemes for differentiating port infrastructure charges according to environmental or sustainability criteria.
Sustainable Shipping Initiative, 2016	<i>Progress to 2015: A Future for Sustainable Shipping</i>	This progress report details the efforts and key achievements of SSI members to drive debate on and inspire change within the shipping sector.
WWF, 2011	<i>Global Sustainable Shipping Initiatives: Audit and Overview 2011</i>	This report updates research conducted in 2004 and highlights the fundamental changes to sustainable shipping initiatives since then. It identifies drivers of these changes and shifts in opinion regarding the best methods of delivering global, sustainable shipping.

**Table B1.** Additional Reference Materials on a Sustainable Ocean Economy, continued

AUTHOR	REPORT	SUMMARY
<b>COASTAL ECOSYSTEMS</b>		
OECD, 2019	<i>Responding to Rising Seas</i>	This report reviews how countries in the Organisation for Economic Co-operation and Development can use their national adaptation planning processes to meet the challenge of rising sea levels. Specifically, the report examines how countries approach shared costs and responsibilities for coastal risk management and how this encourages or hinders risk-reduction behaviour by households, businesses and different levels of government.
World Bank Group, 2016	'Managing Coasts with Natural Solutions: Guidelines for Measuring and Valuing the Coastal Protection Services of Mangroves and Coral Reef'	This guidance note offers recommendations for how to measure and value the protective services of mangroves and coral reefs to support planning for development, disaster risk and coastal zone management.
Center for American Progress and Oxfam America, 2014	<i>The Economic Case for Restoring Coastal Ecosystems</i>	This report explores the economic contributions provided by healthy, restored coastal ecosystems such as wetlands, seagrass beds and oyster reefs. An analysis of three federally funded projects reveals that well-designed coastal restoration can be highly cost-effective, returning significantly more than the cost of the restoration project.
<b>BLUE FINANCE REPORTS</b>		
UNGC, 2020	'Blue Bonds: Reference Paper for Investments Accelerating Sustainable Ocean Business'	This paper outlines the opportunities for the environmental, social and governance bond market to secure capital for ocean-related projects and companies that have made, or are planning to make, significant contributions to the Sustainable Development Goals.
Friends of Ocean Action, 2020	<i>The Ocean Finance Handbook</i>	This handbook provides an up-to-date overview of the investment landscape in the blue economy. It seeks to formulate a common understanding of sustainable blue economy financing for all stakeholders.
Credit Suisse, 2020	<i>Investors and the Blue Economy</i>	This study assesses investor perspectives on the ocean, bringing together views on and awareness of the sustainable blue economy among asset owners and managers worldwide.
IIED, 2019	'Navigating Ocean Investments'	This briefing considers a business model that could bridge the marine conservation funding gap.
Wildlife Conservation Society and Conservation Finance Alliance, 2018	<i>Finance Tools for Coral Reef Conservation: A Guide</i>	This working guide to financial tools available for coral reef conservation highlights 13 of the most compelling finance mechanisms.



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