OECD work in support of a **sustainable ocean**

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BETTER POLICIES FOR BETTER LIVES

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BETTER POLICIES FOR BETTER LIVES

OECD work in support of a sustainable ocean

The ocean is vital for human well-being. Covering over two-thirds of the planet, it contains rich biodiverse habitats, provides invaluable ecosystem services, is central to global food security, and absorbs significant amounts of heat and carbon dioxide. The ocean also presents immense opportunities for economic growth, employment and development. The ocean economy spans multiple sectors – including oil and gas, fishing, aquaculture, shipping, tourism, offshore wind energy, mining, and marine biotechnology – and is growing rapidly. Prior to the COVID-19 pandemic, OECD projected a doubling of the ocean economy from 2010 to 2030, to reach USD 3 trillion and employ 40 million people.

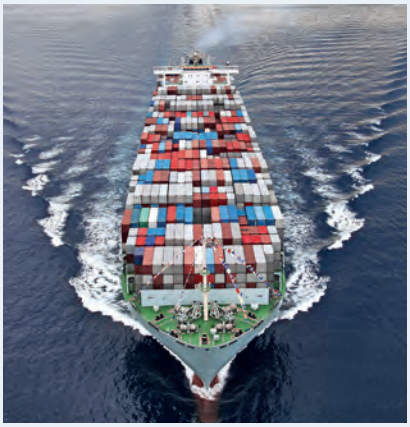
We must manage the ocean well, use its resources sustainably and reduce environmental pressures to realise the full potential of the ocean economy. The ocean is under immense pressure from a wide range of human activities and this will increase unless governments take bold action to ensure the protection of its natural resources. Pollution from plastics, offshore oil and gas, shipping, sewage, and fertiliser and agricultural runoff are significant challenges. Rapid urbanisation of coastal zones further aggravates pollution, habitat loss and resource pressure. Because of ineffective fisheries management and illegal, unreported and unregulated (IUU) fishing, many fish stocks are overfished or have collapsed. Climate change (sea-level rise, ocean warming and ocean acidification) further increases the strain on many species and habitats. All of this severely compromises the health and resilience of marine ecosystems and the ability of the ocean economy to sustainably develop and prosper.

The OECD is helping governments reconcile the ever-growing use of marine resources with the need to safeguard and improve the health of ocean ecosystems. The policy analysis and guidance developed by the OECD helps countries to work

towards fulfilling their international commitments on the ocean including Sustainable Development Goal 14 on Life below Water, the Convention for Biological Diversity's Aichi Targets, the United Nations Convention on the Law of the Sea and the Paris Agreement on climate change. The OECD advocates an integrated, "whole-of-government" approach that responds to the complex challenges facing the ocean by mobilising expertise across many policy fronts, covering environmental, economic, financial and social dimensions.

Examples of our work include:

- Understanding the contribution of the ocean to economic activity and the future potential of ocean-based industry
- Developing and tracking policy and financing approaches for marine conservation and sustainable use
- Supporting governments in increasing recycling rates, curtailing plastics pollution and managing other types of ocean pollution
- Providing guidance on adaptation strategies to respond to rising seas and develop resilient coastal infrastructure
- Helping developing countries harness the benefits of sustainable ocean economies
- Identifying and evaluating fisheries support measures
- Tracking policies and practices to deter IUU fishing
- Proposing solutions to decarbonise maritime transport and decrease pollution from shipping
- Providing a detailed assessment of the technical potential for offshore wind development
- Exploring the role of ocean science, technology and innovation in accelerating sustainable ocean economy outcomes
- Mapping the role of public marine data in ocean economy decision making and valuing its impacts
- Reframing financing and investment for a sustainable ocean economy
- Tracking ocean-related development finance



The ocean economy

Realising the potential of the ocean economy to improve well-being while protecting ocean resources and marine ecosystems is a major challenge that is likely to become increasingly important in coming decades. By mid-century, the world's population is projected to reach at least 9 billion, with corresponding demands for food, jobs, energy, raw materials and economic growth. The potential of the ocean to help meet these requirements is huge, but the ocean is already under stress from overexploitation, pollution, declining biodiversity and climate change. Care needs to be taken to increase the sustainability of the ocean economy while harnessing its benefits.

What is the ocean economy?

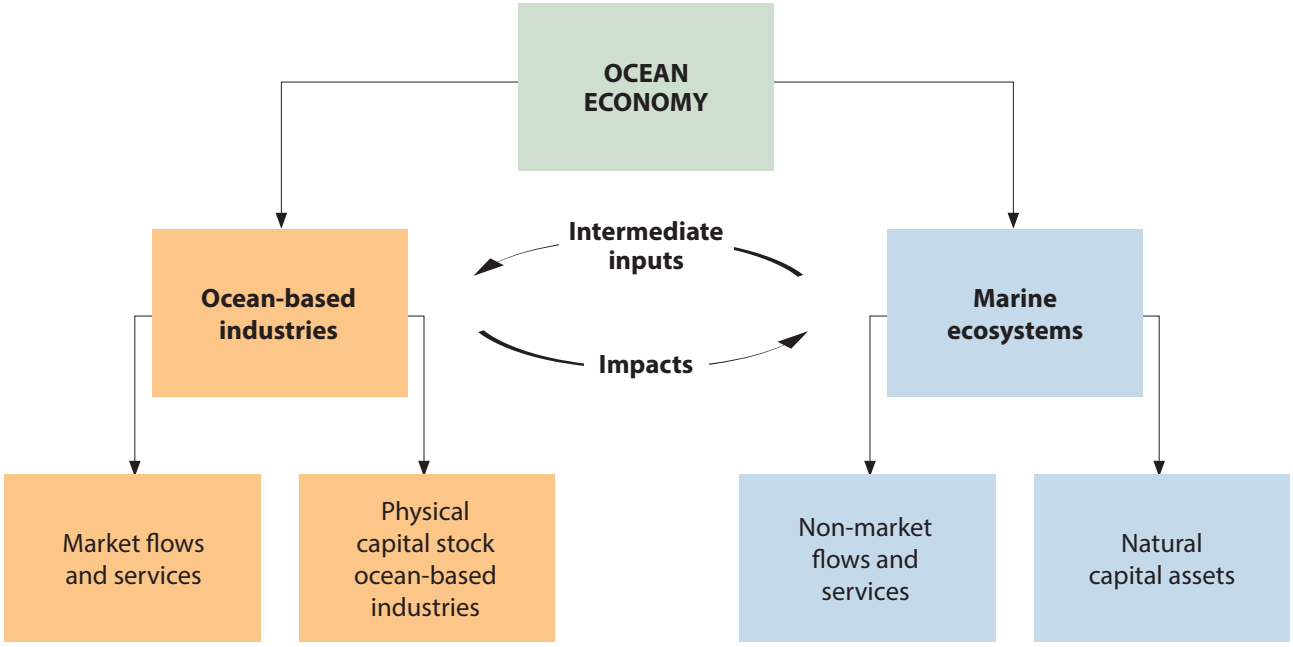
The ocean economy is defined by the OECD as the sum of the economic activities of ocean-based industries, together with the assets, goods and services provided by marine ecosystems (OECD, 2016). These two pillars are interdependent: much activity associated with ocean-based industry is derived from marine ecosystems; and industrial activity often impacts marine ecosystems.

This concept of the ocean economy as an interaction between two pillars is depicted in Figure 1.

The interdependency of ocean-based industries and marine ecosystems, combined with increasingly severe threats to the health of the ocean, have led to a growing recognition of the need for an integrated approach to ocean management (OECD, 2016). An accurate and extensive information base on ocean economic activity, the marine environment and the interactions between the two is crucial to each of these strategies. Greater understanding of the economic value of marine ecosystems could help spur integrated ocean management in support of sustainability goals. The need for this is gaining more attention at national and international levels (OECD, 2019).

Robust data will be fundamental to ensuring ocean-based industries and marine ecosystems are managed in an integrated manner through strategies such as Integrated Coastal Zone Management (ICZM), Marine Spatial Planning (MSP) and Marine Protected Areas(MPA). The OECD, in close co-operation with national and international stakeholders, is currently assessing how to improve the socio-economic evidence on the ocean, building on lessons learned from its initial ocean economy database, developed in the context of an original OECD foresight project on the ocean economy to 2030 (OECD, 2016).

Figure 1. **Today's ocean economy: An interactive, interdependent system**



Source: OECD (2016), *The Ocean Economy to 2030,* OECD Publishing, Paris, https://doi.org/10.1787/9789264251724-en.

The ocean economy could benefit from stimulus packages aimed at more sustainable economies

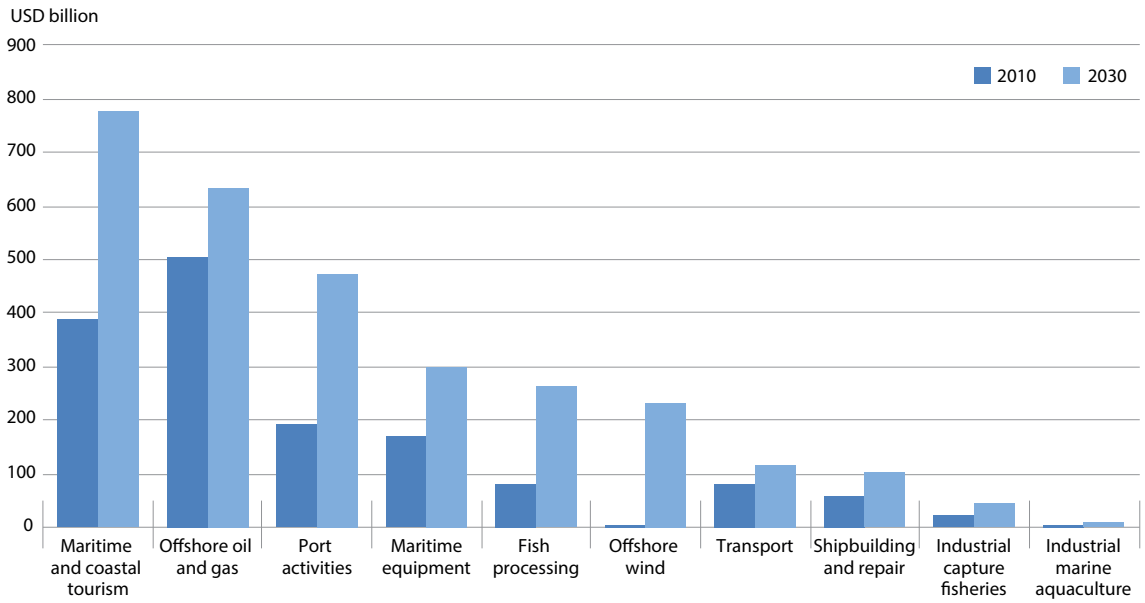
Previous OECD analysis projected a marked acceleration in a range of ocean economic activities by 2030 (OECD, 2016). The estimates suggested the value added generated by ocean-based industries globally could double in size from USD 1.5 trillion in global value added in 2010 to USD 3 trillion in 2030. In particular, marine aquaculture, marine capture fisheries, marine fish processing, offshore wind and port activities were seen as having the potential to outperform the global economy. Based on such growth, major pressures on the marine environment were expected to increase.

Since such analysis was conducted, governments have necessarily taken drastic action in response to the COVID-19 pandemic. Many ocean activities, not least those at the heart of the global trade and transportation system, are affected by measures to control the spread of the disease and the associated economic effects are likely to be major. The precise impacts of this disruption on the future of the ocean economy and on the marine environment remain unclear. Economic activity is broadly expected to slow down and some years may pass before pre-crisis levels are reached again.

The high degree of uncertainty related to the COVID-19 crisis suggests that building strategies to maintain the potential of the ocean economy will be challenging. However, many of the same drivers associated with growth in the ocean economy remain. For instance, longer term demand for marine sources of food, energy, minerals, leisure pursuits and so on is still likely to grow along with the global population. Sustainability should remain a crucial factor in decision making surrounding the ocean economy, as policy makers consider economic stimulus strategies.

The adoption of integrated management strategies, fostering collaboration between ocean science and ocean industry, and improved marine data collection and dissemination are a few actions that could bolster economic activity while contributing to the conservation and sustainable use of marine ecosystems (OECD, 2019; OECD, 2016). Furthermore, the ocean is a source of clean energy (see section "Offshore Wind Energy") and other renewable resources that are as yet underutilised in many parts of the world and could provide sustainable economic activity with well-targeted investments. In light of the pandemic and its impacts, the OECD will continue to study ocean economic activities and their potential future, with a particular emphasis on the role of science, technology and innovation in sustainable development.

Figure 2. **Prior to COVID-19, ocean-based industries' value-added was expected to double by 2030**



Source: OECD (2016), *The Ocean Economy to 2030,* OECD Publishing, Paris, https://doi.org/10.1787/9789264251724-en.

Governments can better track ocean economic activity

The ocean is already under stress from overexploitation, pollution, declining biodiversity and climate change. Business-as-usual expansion of economic activities in the ocean is not an option for the future, as it would further jeopardise the ocean's health and resources, thereby undermining the very basis on which the ocean industries themselves depend. Realising the full potential of the ocean demands ever more responsible and sustainable approaches to its economic development.

In addition to continuing OECD work on measuring ocean industries and their impacts, the OECD recommends two ways to advance economic measurement at the national level to provide public authorities further evidential support (OECD 2019):

1. **Standardising approaches to measuring and valuing ocean industries, and integrating them into national accounting via satellite accounts.**

   Building upon existing national- and industry-level data collection efforts, ocean economy satellite accounts would provide a highly organised method for collecting and disseminating consistent ocean economy data. The development of satellite accounts can offer a framework for monitoring aspects of a country's ocean economy not shown in detail in the core national accounts, while allowing for greater flexibility for ocean-based industries not covered by industrial classifications, and enabling, in time, international comparability. The OECD is currently developing with national stakeholders practical concepts and new ocean-based industry datasets for ocean economy satellite accounts.

2. **Measuring natural marine resources and ecosystem services, while also exploring ways to integrate them into national accounting frameworks**

   Given the strong interdependency between ocean economic activities and marine ecosystems, a national accounts framework is the best way to integrate the measurement of these two pillars of the ocean economy in a meaningful and policy-relevant way. As the knowledge base on marine ecosystems' accounting builds, more efforts from countries to share experiences will greatly benefit the process of refining both the international environmental accounting guidelines and marine ecosystem services' classifications.

OECD sustainable ocean economy database and policy platform

The OECD is building a comprehensive database on a sustainable ocean economy. Reliable and timely data on the sustainability of the ocean economy, the well-being and resilience of coastal communities and the health of marine ecosystems are scarce. This work helps meet the demands of the international community for a better evidence base to support decision making, including SDG 14.

The **sustainable ocean economy database** helps answer the following questions:

- Are we becoming more efficient in using marine ecosystem services?
- Is the natural asset base of the ocean being maintained?
- How does a sustainable ocean economy benefit people?
- What are the opportunities arising from promoting a sustainable ocean economy?
- What policy responses are needed to speed up the transition?

An accompanying webbook showing the main trends from the database is available at: https://www.oecd.org/environment/environment-at-a-glance/

The **sustainable ocean policy platform** is an interactive repository of good practices that draws on existing research and policy advice from across a range of OECD work – including marine biodiversity and ecosystem services, climate, pollution, infrastructure resilience and sustainable ocean finance. The platform supports countries by providing the necessary knowledge base for pursuing policies towards ensuring a sustainable ocean economy.

KEY PUBLICATIONS

OECD (2019), *Rethinking Innovation for a Sustainable Ocean Economy*, OECD Publishing, Paris, https://doi.org/10.1787/9789264311053-en.

OECD (2016), *The Ocean Economy to 2030*, OECD Publishing, Paris, https://doi.org/10.1787/9789264251724-en.

KEY WEBSITES

www.oecd.org/sti/inno/ocean-economy
http://stats.oecd.org/index.aspx?datasetcode=OCEAN
http://oe.cd/env-glance
www.oecd.org/ocean

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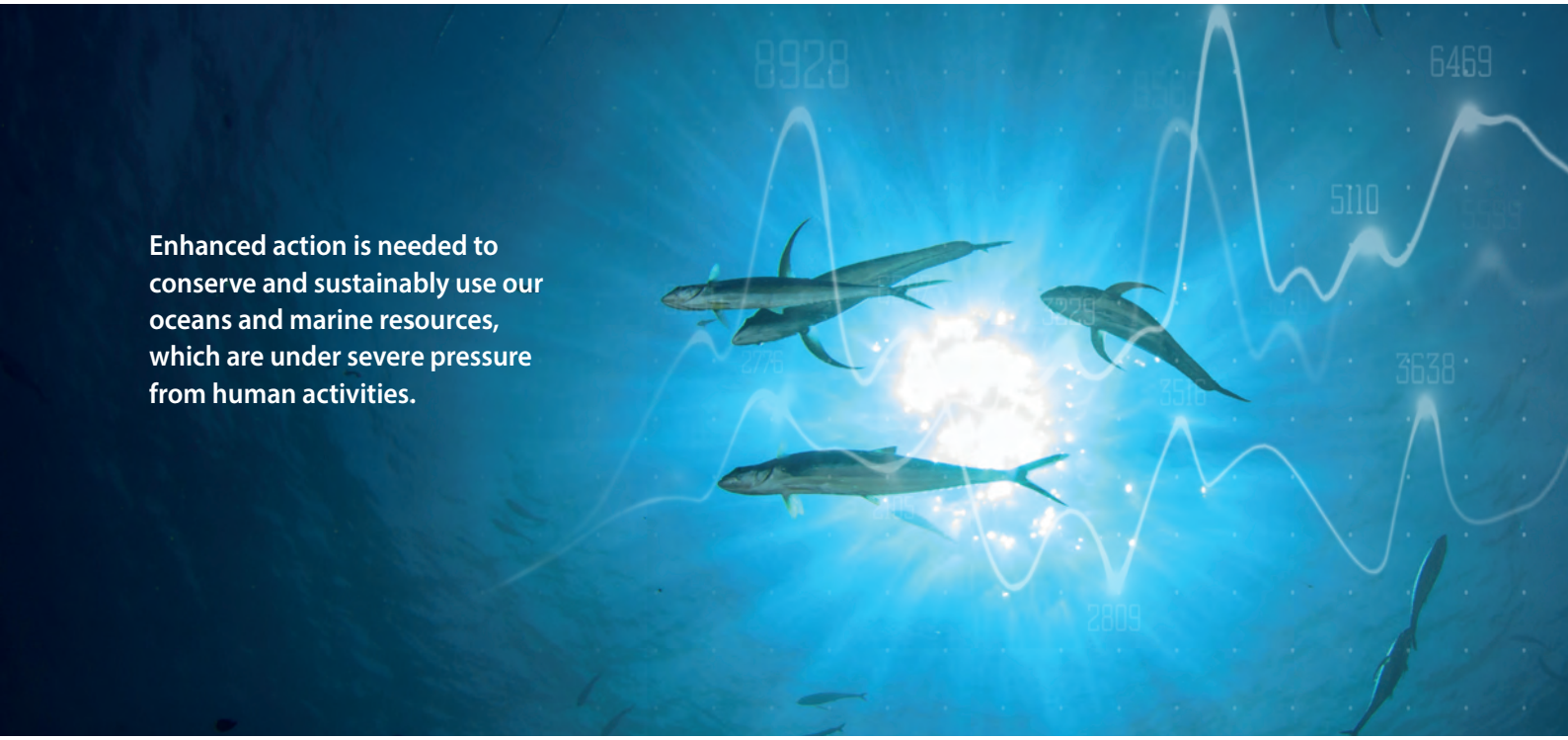
Ocean conservation and sustainable use

Healthy oceans and marine ecosystem services underpin the ocean economy, and provide critical support functions upon which human health and well-being depend. The multiple benefits that can be derived from healthy and resilient marine ecosystems are local, regional and global in scale, and range from coastal and habitat protection to climate mitigation and food provisioning. Coral ecosystems alone have been estimated to provide the world economy with an average annual value of USD 172 billion. This value is based on ecosystem services including food and raw materials, moderation of extreme ocean events, water purification, recreation, tourism, and maintenance of biodiversity.

Policy action is not keeping pace with pressures on the ocean

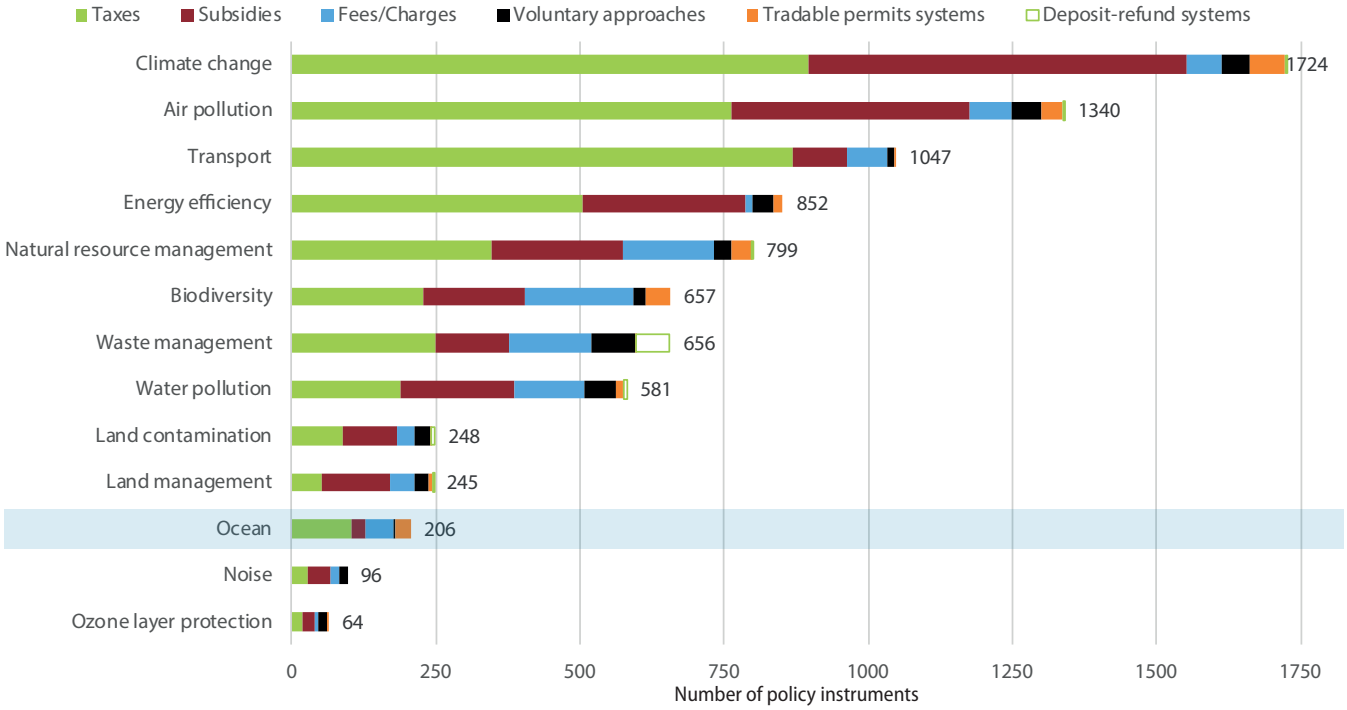
Enhanced action is needed to conserve and sustainably use our oceans and marine resources, which are under severe pressure from human activities, notably over-exploitation of fish and other marine resources, habitat destruction, invasive alien species, pollution and climate change (OECD, 2017a). Governments have a key role to play in putting in place an effective and coherent policy mix to ensure the achievement of SDG 14, to conserve and sustainably use our oceans, seas, and marine resources, and the relevant 2011-2020 Aichi Biodiversity Targets under the Convention on Biological Diversity. Relevant policy instruments include regulatory, economic, and information and voluntary approaches (Table 1). Despite recent progress, the pace of policy action is not keeping up with the pressures on oceans.

Marine protected areas (MPAs), one of the more traditional policy instruments for marine conservation and sustainable use, have been expanded in recent years and are one of the few Aichi and SDG 14 targets on track to be met by 2020. The extent to which they cover the full spectrum of marine life is still weak, however, and management effectiveness often poor (OECD, 2017a). MPAs must also be better integrated into emerging marine spatial planning instruments to increase effectiveness (OECD, 2017b), and complemented with a robust mix of other policy instruments to address the multiple pressures on the ocean. *Marine Protected Areas: Economics, Management and Effective Policy Mixes* (OECD 2017a) examines the evidence on the costs and benefits of MPAs and presents good practice insights on how to enhance the environmental and cost effectiveness of MPAs, and to scale up finance.



Enhanced action is needed to conserve and sustainably use our oceans and marine resources, which are under severe pressure from human activities.

Figure 3. **There is untapped potential to expand economic policy instruments for ocean conservation and its sustainable use**



Note: Based on 110 countries reporting to the database. Multiple tags per instrument are possible.
Source: OECD Policy Instruments for the Environment (PINE) database (accessed on 25 March 2020)

Biodiversity can be mainstreamed through effective sectoral policies

Mainstreaming marine conservation and sustainable use across all sectors of the ocean economy is vital to ensuring the sustainability of the ocean economy. This is best brought about through better understanding of the benefits provided by ocean and marine ecosystems, including their values. Marine ecosystems considerations must then be mainstreamed in national development strategies, marine spatial planning policies and fisheries plans, among others. Effective policies must be put in place to ensure externalities are addressed, and that robust monitoring and evaluation of mainstreaming occurs over time. *Mainstreaming Biodiversity for Sustainable Development* (OECD, 2018a) draws on experiences and insights from 16 predominantly megadiverse countries to examine how biodiversity is being mainstreamed at the national level in agriculture, forestry and fisheries sectors and in development co-operation. It also considers the monitoring and evaluation of biodiversity mainstreaming and how this could be improved. Key messages from the report include the need to establish a strong social and business case for biodiversity; to develop monitoring and evaluation systems for mainstreaming; and to align policies across biodiversity and the different sectors.

Overcome and avoid political obstacles to policy reform

Political economy issues such as competitiveness concerns, distributional implications and vested interests can act as a brake on policy reform. This makes the study of barriers to effective marine policy reform and how they might be overcome vital. *The Political Economy of Biodiversity Policy Reform* (OECD, 2017c) provides insights on the types of obstacles that have been encountered in designing and implementing effective marine and terrestrial biodiversity policy reform. Drawing on recent examples of relevant policy reforms in a number of countries, the publication provides key messages on how these obstacles can be overcome, including building alliances between economic and environmental interests, devising targeted measures to address potential impacts on competitiveness and income distribution, and building a robust evidence base to support reform and provide resistance to pressure from vested interests.

Recent OECD work has also examined ocean-relevant economic instruments that governments have put in place, covering taxes, fees and charges, subsidies, and tradable permit schemes. The information is derived from the OECD Policy Instruments for the Environment (PINE) database, to which 110 countries currently contribute (Figure 3). This enables to identify policy instruments that are relevant to SDG 14 (Conserve and sustainably use the oceans, seas and marine resources). While most of these policy instruments are relevant to the conservation and sustainable use of biodiversity (covering both terrestrial and marine ecosystems), there is not 100% overlap in those instruments tagged as (marine) biodiversity-relevant and those tagged as ocean-relevant, as in some cases, there may also be trade-offs involved in achieving different environmental objectives.

Evaluate and improve marine biodiversity policies

While scaling up policy instruments for ocean conservation and sustainable use is crucial in order to achieve SDG 14 and related goals, further effort is also needed to evaluate the effectiveness of existing policy instruments, and how they can be improved. A recent inventory of rigorous impact evaluation studies identifies 80 studies that examine how biodiversity policies have fared. However, less than a handful of these focussed on marine biodiversity as opposed to terrestrial biodiversity issues (Karousakis, 2018). A key

Mainstreaming marine conservation and sustainable use across all sectors of the ocean economy is vital to ensuring the sustainability of the ocean economy.

message from the report is that governments could endeavour to develop a strategic approach to scale up impact evaluation (and cost-effectiveness analysis) studies so as to build a stronger evidence base for more environmentally- and cost-effective biodiversity policy instruments. This could include considerations of geographic representability, ensuring a good balance between different policy instruments and terrestrial and ocean/marine ecosystems, and ideally prioritising larger initiatives.

To support development of the Post-2020 Global Biodiversity Framework, the OECD is undertaking work on biodiversity targets and indicators and their measurability implications at the global and national levels, relevant to both SDG 14 and SDG 15. The analysis is examining how the Post-2020 Biodiversity Framework could be designed to be more specific and measurable, along the pressure-state-response target and indicator framework, and includes how to better monitor progress towards biodiversity mainstreaming. The OECD is also working to develop guidance to identify and assess subsidies harmful to biodiversity at the national level.

KEY PUBLICATIONS

OECD (2019), *Biodiversity: Finance and the Economic and Business Case for Action*, OECD Publishing, Paris, https://doi.org/10.1787/a3147942-en.

Karousakis, K. (2018), "Evaluating the effectiveness of policy instruments for biodiversity: Impact evaluation, cost-effectiveness analysis and other approaches", *OECD Environment Working Papers,* No. 141, OECD Publishing, Paris, https://doi.org/10.1787/ff87fd8d-en.

OECD (2018a), *Mainstreaming Biodiversity for Sustainable Development,* OECD Publishing, Paris, https://doi.org/10.1787/9789264303201-en.

OECD (2018b), "Tracking Economic Instruments and Finance for Biodiversity 2018", http://oe.cd/econ-instruments4biodiversity-2018.

OECD (2017a), *Marine Protected Areas: Economics, Management and Effective Policy Mixes,* OECD Publishing, Paris, https://doi.org/10.1787/9789264276208-en.

OECD (2017b), "Marine Spatial Planning: Assessing net benefits and improving effectiveness", *Green Growth and Sustainable Development Issue Paper,* OECD Publishing, Paris. https://oe.cd/ggsd2017msp.

OECD (2017c), *The Political Economy of Biodiversity Policy Reform,* OECD Publishing Paris, https://doi.org/10.1787/9789264269545-en.

KEY WEBSITES

http://oe.cd/biodiversity
http://oe.cd/post-2020-biodiversity-workshop

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Table 1. **A variety of policy instruments exist for marine conservation and sustainable use**

Regulatory instruments (i.e. command-and-control)	Economic instruments	Information and voluntary approaches
Marine protected areas	Taxes, charges, user fees (e.g. entrance fees to marine parks)	Certification, eco-labelling
Marine spatial planning and multi-annual management plans	Rights based management systems (e.g. individually transferable quotas for fisheries)	Voluntary agreements, including public-private partnerships (which can include, for example, voluntary biodiversity offset schemes)
Spatial and temporal fishing closures; bans and standards on fishing gear; limits on number and size of vessels; other restrictions or prohibitions on use (e.g. CITES)	Subsidies to promote biodiversity – and the reform of environmentally harmful subsidies	
Catch limits or quotas (output controls)	Payments for ecosystem services (PES)	
Standards (e.g. MARPOL for ships); bans on dynamite fishing	Biodiversity offsets	
Licenses (e.g. aquaculture)	Non-compliance penalties	
Planning requirements (e.g. environmental impact assessments and strategic environmental assessments)	Fines on damages	

Note: CITES: Convention on International Trade in Endangered Species; MARPOL: International Convention for the Prevention of Pollution from Ships ("marine pollution").
Source: Adapted from OECD (2017a), *Marine Protected Areas: Economics, Management and Effective Policy Mixes.*

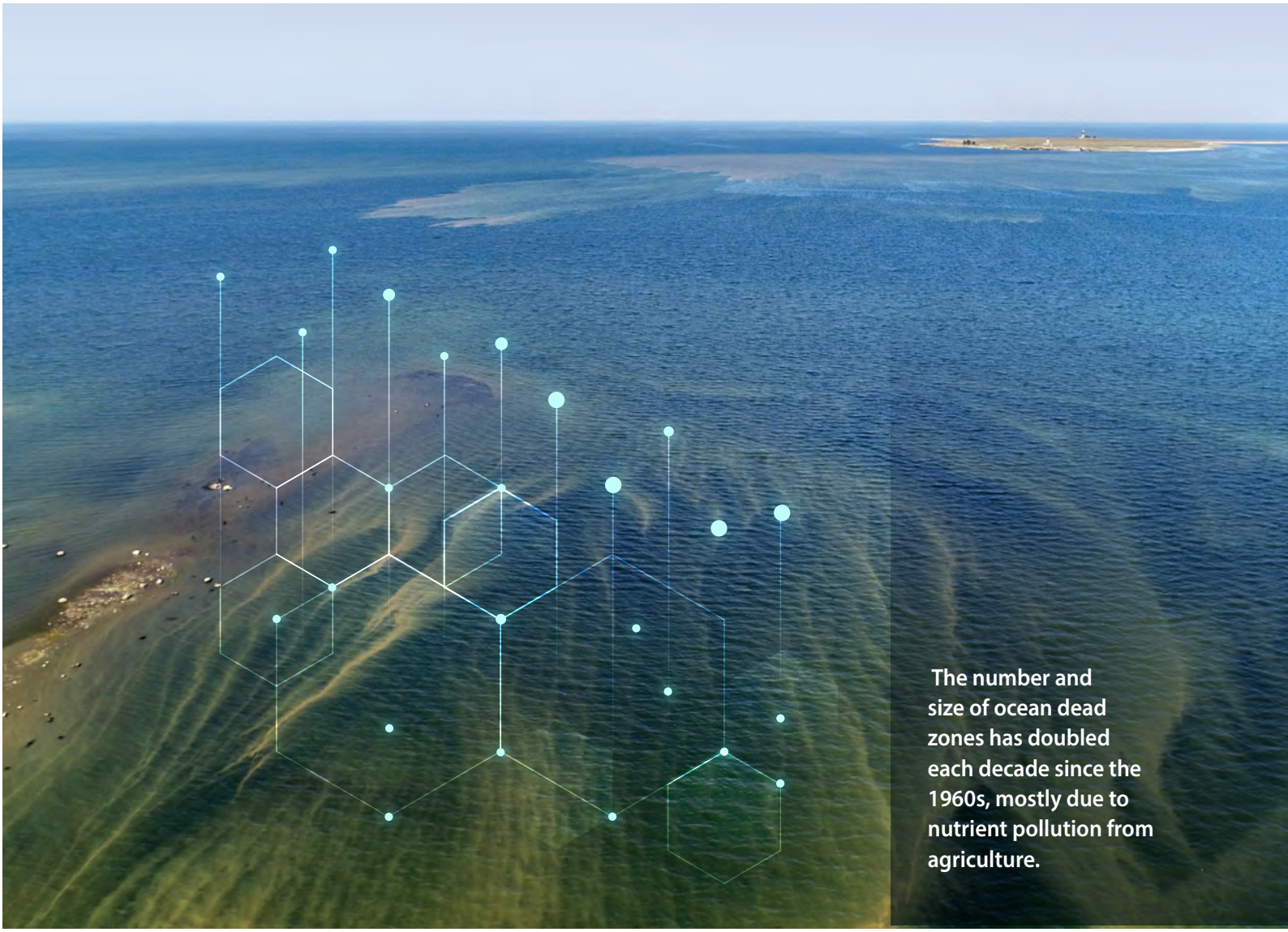
Ocean pollution

The oceans are under increasing stress from multiple urban and rural sources of pollution, notably solid and liquid wastes from cities, pharmaceutical residues, fertiliser and manure run-off from farming, air emissions from shipping, and incorrect disposal of plastic from land-based and sea-based sources.

Eutrophication and ocean dead zones are a growing global challenge

Globally, one of the most prevalent water quality challenges is eutrophication; a form of water pollution caused by excess use of nutrients (nitrogen and phosphorous). Eutrophication can trigger toxic algal blooms and cause "dead zones" (oxygen depletion) in the ocean and coastal waters leading to significant loss of marine biodiversity. Excessive nitrogen in the environment also contributes to climate change, depletion of the ozone layer, air pollution, nitrate toxicity in groundwater and drinking water, loss of biodiversity and deterioration of soil quality.

Figure 4 shows coastal and ocean sites where anthropogenic nutrients, such as nitrogen from fertilisers and livestock manure, have exacerbated or caused low oxygen levels (shaded blue areas), leading to the formation of dead zones (red dots). The number and size of ocean dead zones has doubled each decade since the 1960s, mostly due to nutrient pollution from agriculture.



The number and size of ocean dead zones has doubled each decade since the 1960s, mostly due to nutrient pollution from agriculture.

Manage and prevent water pollution risk

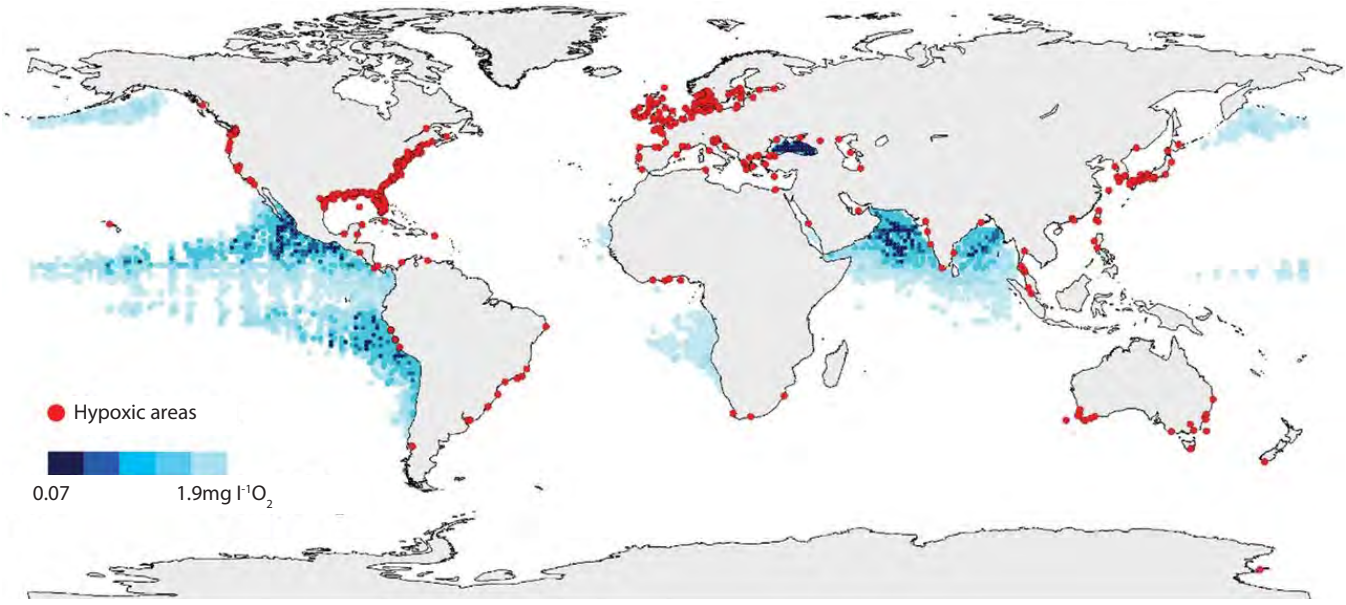
Improving water quality from source-to-sea requires managing both point and diffuse sources of pollution. The distinction between the two sources is an important function of water quality policy and pollution regulation.

Point sources of pollution are largely controlled in OECD countries. However, contaminants raise emerging concern; for example, pharmaceutical residues, microplastics or other substances can have harmful consequences for human health and freshwater, coastal and marine ecosystems. Mitigation requires a joint approach with industry, as wastewater collection and treatment alone will not suffice and comes at a high cost. In the case of pharmaceutical residues, OECD promotes a life-cycle approach, with active co-operation of all players, from research and manufacturing, to healthcare and the water industry.

Diffuse sources of pollution prevail in OECD countries and limiting diffuse water pollution within acceptable boundaries is essential. An optimal strategy entails a mix of policy interventions reflecting the basic OECD principles of water quality management – pollution prevention, treatment at source, the polluter – pays and beneficiary – pays principles, equity, and policy coherence. While water quality goals are at the core of a policy response, many other sectoral policy frameworks need to be aligned if efforts to reduce the costs of diffuse pollution are to be fruitful. *Pharmaceutical Residues in Freshwater: Hazards and Policy Responses* (OECD, 2019), *Human Acceleration of the Nitrogen Cycle: Managing Risks and Uncertainty* (OECD, 2018) and *Diffuse Pollution, Degraded Waters: Emerging Policy Solutions* (OECD, 2017) examine the risks and provide a combination of policy recommendations and measures to tackle this growing global challenge. OECD reports *Water Governance in Cities* (OECD, 2016) and *Water and Cities: Ensuring Sustainable Futures* (OECD, 2015) explore policy responses at the central and local government levels. They focus on mutually dependent dimensions of governance, finance, innovation and urban-rural linkages.

Nitrogen requires a different approach, as it disseminates in water, air and soil. A three-pronged approach is called for to tackle nitrogen pollution: 1) in the context of air, water and biodiversity policies, manage the risks of local pollution by better understanding the nitrogen pathways between sources and impact (the "spatially targeted risk approach"); 2) in the context of climate change mitigation and ozone layer protection policies, take into account global atmospheric concentrations of nitrous oxide (the "global risk approach"); and 3) monitor remaining nitrogen surplus (through a national nitrogen balance) and assess the most cost effective ways of maintaining it at a level

Figure 4. **Anthropogenic nutrients exacerbate or cause low oxygen-levels and dead zones**



Source: Breitburg, D. et al (2018), "Declining oxygen in the global ocean and coastal waters", *Science*, 5 January, https://science.sciencemag.org/content/359/6371/eaam7240.

acceptable to society (the "precautionary approach"). Economic instruments, such as pollution charges or tradable entitlements, are an underutilised means of increasing the cost effectiveness of pollution control strategies while simultaneously promoting innovation.

Shipping can have substantial environmental impacts

Global shipping is responsible for approximately 30% of total global nitrogen oxide (NOx) emissions. These emissions have been linked to thousands of premature deaths in coastal areas. Ships account for approximately 2.5% of total global greenhouse gas (GHG) emissions. Other environmental impacts from shipping include biodiversity impacts related to ballast water and the effect of noise pollution on ocean wildlife. Global policy efforts have recently focused on sulphur and GHG emissions from ships and ballast water management, but efforts could be intensified with respect to NOx and particulate matter (PM) emissions.

The International Transport Forum (ITF) at the OECD has conducted various studies that aim to provide policy makers with tools to reduce air emissions from shipping. A list of these studies are in the Ocean shipping and shipbuilding section of this brochure.

Pervasive plastic debris negatively affects ocean ecosystems

Global plastics production has increased from virtually nothing in 1950 to more than 400Mt in 2015 (Figure 5). Plastic is present in all the world's ocean basins, including around remote islands, the poles and in the deep seas. Up to 13 million tonnes are estimated to be introduced to the oceans each year (Jambeck et al., 2015). Plastic that accumulates in the natural environment will only decompose over hundreds or even thousands of years.

Approximately 80% of marine plastic debris originates from land-based sources and is transported to the ocean through rivers, with the remaining share of debris coming from fishing activities, natural disasters and other sources (Jambeck et al., 2015). Marine debris encompasses large objects, microplastics and nanoplastics. It affects the environment and marine ecosystems through, for example, ingestion or entanglement by species who live in them. Microplastics – which are estimated to represent 15% of the weight of mismanaged plastics waste (IUCN, 2017) – may travel up the food chain and pose potential risks to human health once ingested. Marine litter also leads to a range of socioeconomic impacts to tourism, fishing and aquaculture, and shipping (UN Environment, 2017).

Policy efforts should focus on curbing the plastics inflow to the ocean

The removal of plastic debris from open ocean environments is, at best, difficult and costly for floating debris, and at worst, infeasible or impossible for microplastics and plastic within the water column and seabed sediment. The most effective mitigation strategies must focus on reducing the inflow of plastics to the marine environment. This requires a two-pronged approach to tackle plastics litter originating from both land- and sea-based sources:

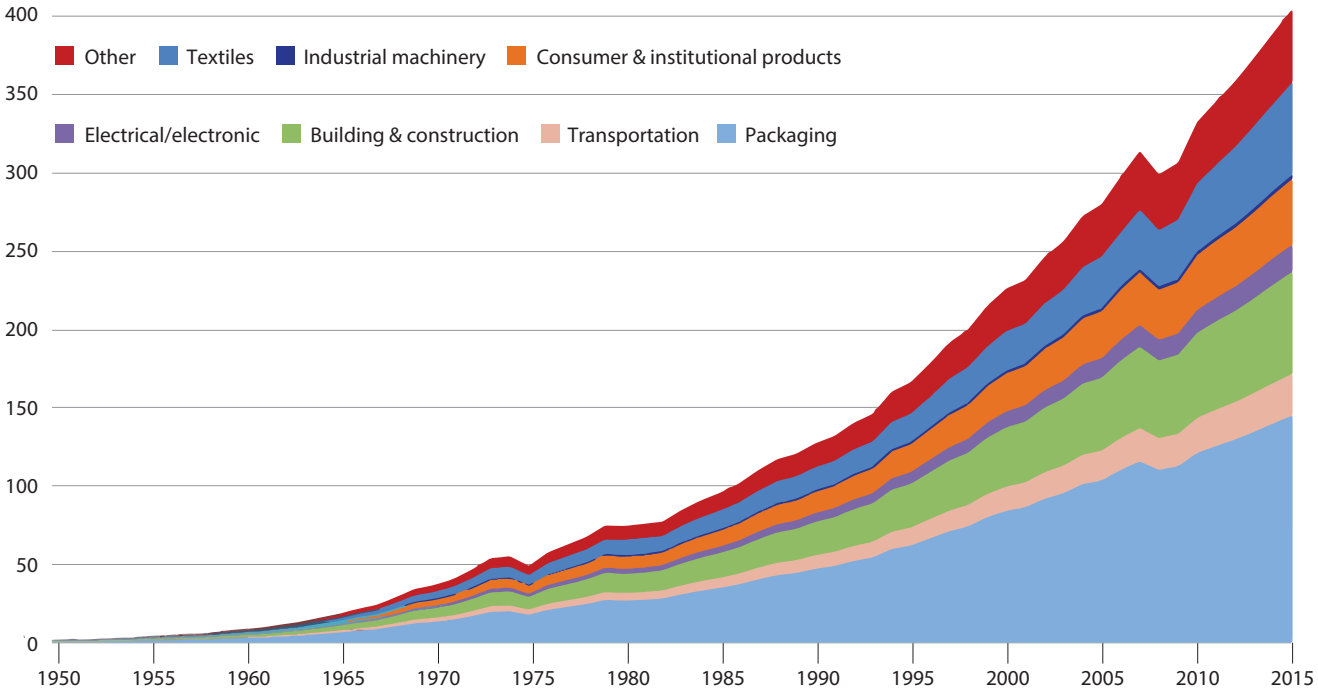
- **Plastics waste prevention** can be achieved through leveraging incentives along the value chain, and by addressing negative externalities associated with plastics production upstream and plastics waste generation and littering downstream. Policy interventions to foster plastic waste prevention include the introduction of price signals (e.g. through taxes on disposable plastic goods or deposit-refund schemes for reusable packaging), product bans for particularly harmful products which are prone to leakage but unlikely to be collected and recycled (e.g. microbeads), product durability standards and consumer education campaigns. Particular attention should be paid to short-lived products such as single-use plastic goods.
- **Improvement of waste management systems to ensure adequate end-of-life treatment of plastic waste**: an estimated 14 to 18% of waste plastics generated globally are collected for recycling and 24% is incinerated. The remainder is disposed of in landfills, via open burning or uncontrolled dumping, or released to the wider environment. Strengthening waste collection, recycling and disposal systems, such as through the introduction of extended producer responsibility, can increase recycling rates of plastics, stopping the discharge of plastic debris into the ocean. In developing countries, official development assistance can be used to support the creation and operation of effective collection systems and waste-treatment infrastructure.

The OECD focuses on both approaches. The report *Improving Markets for Recycled Plastics: Trends, Prospects and Policy Responses* (OECD, 2018) discusses the reasons behind low recycling rates of plastics and policy approaches to improve them, including measures to create a separate market for recycled plastics where its price is decoupled from virgin plastics, and ways to increase the quantity and quality of recovered plastics.

The *2018 OECD Global Forum on Environment*, addressed the sustainable design of plastics, with a focus on the criteria that define sustainable plastics, the tools available to designers, and the policies that can help to incentivise their design.

Figure 5. **Global primary plastics production has grown exponentially across industrial use sectors, 1950–2015**

Primary plastic production in million tonnes (Mt)



Source: Geyer, R., Jambeck, J. R., & Law, K. L. (2017). *Production, use, and fate of all plastics ever made,* https://doi.org/10.1126/sciadv.1700782

Current OECD work to tackle the marine plastic problem focusses on the design of policies to prevent the generation and leakage into the environment of specific types of waste for example single-use plastics and microplastics. Examining evidence from policies already in place, the OECD assesses the environmental, behavioural and economic impact of different waste prevention policy approaches targeting single-use plastics.

In the field of microplastics, OECD work focuses on unintentionally-released microplastics from two of the largest sources of particles - synthetic textiles and tyres. This work aims to identify possible mitigation options (i.e. technologies and best pratices) to curb the leakage of microplastics in the environment, and policy approaches needed to support their development and adoption. Further, ongoing OECD work aims to provide an economic assessment of the infrastructure and policy efforts needed to stop plastic litter from reaching the ocean.

In the field of sustainable plastics design, work is ongoing to develop a set of criteria for the design of sustainable plastics from a chemicals perspective. Additional work will investigate how specific policy approaches such as extended producer responsibility can support a shift to product eco-design, including for plastics products.

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The ocean and climate change

The ocean regulates the global climate by mediating temperature and determining rainfall, droughts and floods. *The Intergovernmental Panel on Climate Change (IPCC) Special Report on the Ocean and Cryosphere in a Changing Climate (2019)* found that the ocean has warmed unabated since 1970 and already absorbed over 90% of the excess heat trapped by the rising concentration of greenhouse gases. While the ocean's ability to store heat has slowed global warming, this in turn is changing the ocean's chemistry. The IPCC report found that the ocean is warmer, more acidic and less productive, with severe impacts on the complex interactions between continued emissions of greenhouse gases and changes in the ability of the ocean to store excess heat will be a major determinant of the speed and magnitude of long-term climate change impacts, with global economic implications.

Coastal communities are at the front lines of climate change

Coastal communities are disproportionately impacted by increasing greenhouse gas emissions. Warming is leading to the melting of inland glaciers and ice, causing rising sea levels with significant impacts on coastal areas such as coastal flooding and erosion, saltwater intrusion and habitat destruction. Communities and infrastructure are already under pressure from coastal flooding and erosion. Without adaptation, flood damage under high-end sea-level rise (1.3 metres) would be approximately 4% of world GDP annually (Figure 6). Marine ecosystems are similarly being severely impacted. The *Special Report on Global Warming of 1.5°C* (IPCC, 2018) found coral reefs are likely to decline between 70% and 90% if the temperature increased to 1.5°C. If global warming reaches 2°C, more than 99% of coral reefs are projected to decline.

A decisive transition is needed and delaying climate action will increase costs

The report *Investing in Climate, Investing in Growth* (OECD, 2017) shows how governments can not only build strong economic growth but also limit future climate damages if they collectively act for a "decisive transition" by combining consistent, growth-enhancing policies with well-aligned policy packages for mobilising investment in low-carbon, climate-resilient infrastructures and technologies.

There are significant costs associated with delaying action to reduce emissions. If more stringent policies are introduced later, they will affect a larger stock of

high-carbon infrastructure built in the intervening years, leading to higher levels of stranded assets across the economy. Investment in modern, smart and clean infrastructure in the next decade is hence a critical factor for the low carbon transition and sustainable economic growth. *Financing Climate Futures: Rethinking Infrastructure* (OECD/The World Bank/UN Environment, 2018) focuses on how governments can more effectively align financial flows with climate and development priorities and move beyond the current incremental approach to climate action across planning, innovation, public budgeting, financial systems, development finance and cities.

Countries must increase climate ambition

Efforts to mitigate climate change are likely to be more successful and less costly when climate action and broader efforts towards human well-being and sustainable development are mutually supportive. Part I of *Accelerating Climate Action: Refocusing policies through a well-being lens* contains five sector-specific chapters, dedicated to major emitting sectors (electricity, heavy industry, residential, transport and agriculture) that address rethinking policy goals and reframing the measurement system (OECD, 2019a). Part II of the report will analyse and evaluate the implications of applying a well-being lens to formulate climate strategies across the same five sectors (OECD, forthcoming). It will also analyse and evaluate how different climate polices can support or hinder the achievement of wide well-being goals. Policy analysis will be illustrated with examples of how cities and countries have been able to realise the benefits of using a well-being lens.

Resilient infrastructure is needed

Infrastructure networks will be affected by the physical impacts of climate variability and change, such as increased coastal flooding. They will also play an essential role in building resilience to those impacts. New infrastructure assets should be prioritised, planned, designed, built and operated to account for the climate changes that may occur over their lifetimes. Existing infrastructure may need to be retrofitted, or managed differently, because of climate change. The policy paper "Climate Resilient Infrastructure" (OECD, 2018) outlines the co-ordinated response needed to ensure that new and existing infrastructure networks are resilient to climate change impacts.

In addition to making infrastructure resilient to change, additional infrastructure, such as sea walls, will need to be constructed to address the physical impacts of climate change. Coastal protection can reduce the future costs of sea-level rise by 2-3 orders of magnitude. However, in the context of rising risks, there is a need to move to a flexible, forward-looking approach to resilience. This includes integrating hard infrastructure with nature-based solutions (e.g. protection or restoration of coastal ecosystems), new technologies for accommodating flood risk (e.g. permeable pavement), and potential managed retreat in some areas. The policy paper "Innovative Approaches to Building Resilient Coastal Infrastructure" (OECD, 2018) explores ways governments can harness innovation in information, planning, financing and monitoring to help improve the resilience of coastal areas to climate change, and emphasises the need for close engagement with coastal communities.

Without adaptation, flood damage under high-end sea-level rise (1.3 metres) would be approximately 4% of world GDP annually (USD 50 trillion annually). Adaptation measures have the ability to reduce these costs by 2-3 orders of magnitude.

Coastal communities must adapt to rising seas

There is an urgent need to ensure that coastal communities are adapting to the impacts of rising seas. *Responding to Rising Seas: OECD Country Approaches to Tackling Coastal Risks* (OECD, 2019b) reviews how OECD countries can use their national adaptation planning processes to respond to this challenge. 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. The report outlines policy tools that national governments can use to encourage an efficient, effective and equitable response to ongoing coastal change, such as introducing land-use regulation that includes sea-level rise considerations. It is informed by new analysis on the future costs of sea-level rise, and the main findings from case studies in Canada, Germany, New Zealand and the United Kingdom.

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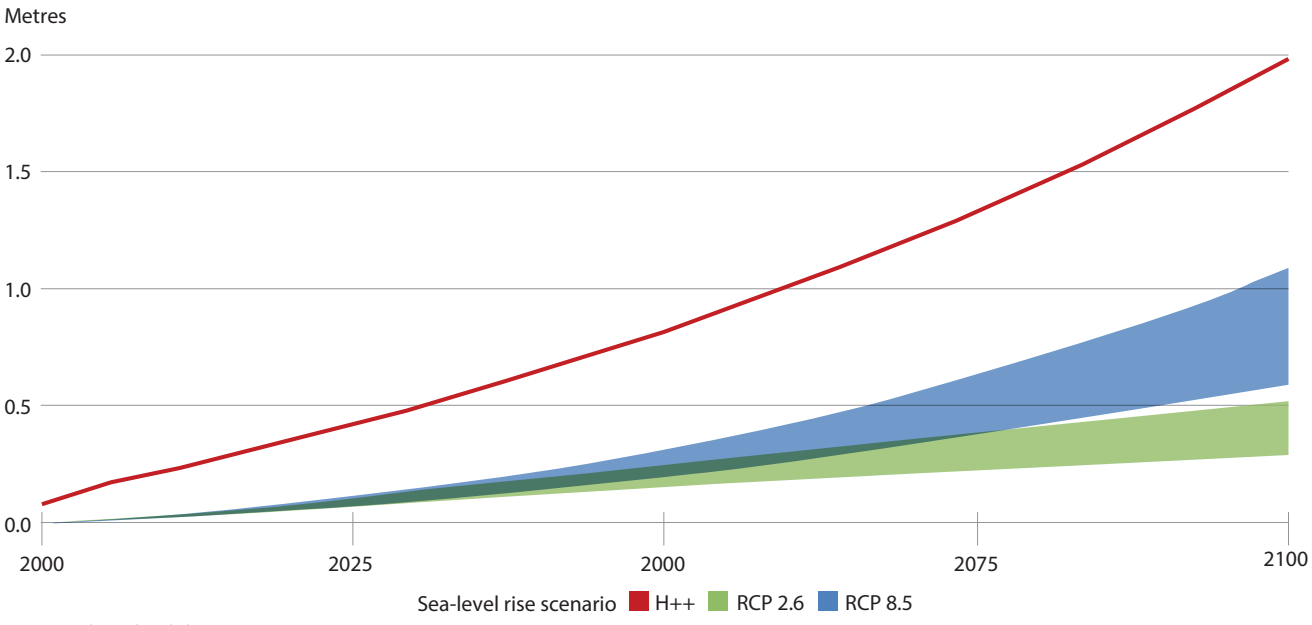
Figure 6. **Sea-level scenarios to 2100**
All sea-level rise values shown are with respect to mean sea-level in the 1985-2005 reference period



Source: Lincke and Hinkel, 2018

For many developing countries, ocean-based industries represent critical sources of employment and income. Fish and fish products account for up 80% of GDP in Small Island Developing States in the Pacific, and tourism for about 20%.

Developing countries and the ocean economy

More than three billion people rely on the ocean for their livelihoods, the vast majority in developing countries. For many of these countries, ocean-based industries are important drivers of economic development, representing critical sources of employment and income. Fish and fish products account for up to 80% of GDP in Small Island Developing States (SIDS) in the Pacific, and tourism for about 20% (Figure 7). With the global ocean economy projected to double in size by 2030 (OECD, 2016), great untapped opportunities to increase economic benefits exist for countries around the world, especially for developing countries with large marine areas under national jurisdiction (Figure 8). Expanding existing ocean-based sectors and investing in new sectors, such as offshore renewable energies and marine biotechnologies, could significantly help developing countries boost energy, food, and infrastructure and tackle critical challenges such as poverty, high unemployment, and food insecurity.

Pressures on the ocean and the ecosystem services it provides, however, are mounting rapidly, and undermine its ability to support long-term sustainable development. In many developing countries, ocean-related sectors have expanded with insufficient consideration for environmental and social sustainability. This puts at risk the natural resources on which these sectors depend and the future socio-economic benefits that they can deliver. Many developing countries are also at the forefront of the impacts of climate change and ocean pollution. These are rapidly deteriorating the marine ecosystems these countries depend upon. The poorest segments of their populations suffer the most. Therefore, developing a sustainable ocean economy is critical to preserve the health of the ocean and ensure future prosperity. It entails achieving sustainability across existing and new economic, social and environmental sectors.

Developing a sustainable ocean economy requires access to adequate knowledge, innovations, capacity and financial resources, which developing countries often lack. The international community can play a pivotal role by helping developing countries adopt adequate regulations and policies, generate expertise and technical capacities, and access the resources required for a strategic approach to a sustainable ocean economy.

The potential of the ocean economy is particularly important for SIDS

SIDS face unique development challenges due to their small populations, remoteness, and exposure to natural disasters and climate change, which result in small production bases, high perceived investment risks, and limited economic growth prospects. Although SIDS have limited land area, they possess some of the world's largest economic exclusion zones, often exceeding their land area many times over (Figure 9). For SIDS,

the greatest scope for economic diversification and expansion lies within the vast oceans surrounding them.

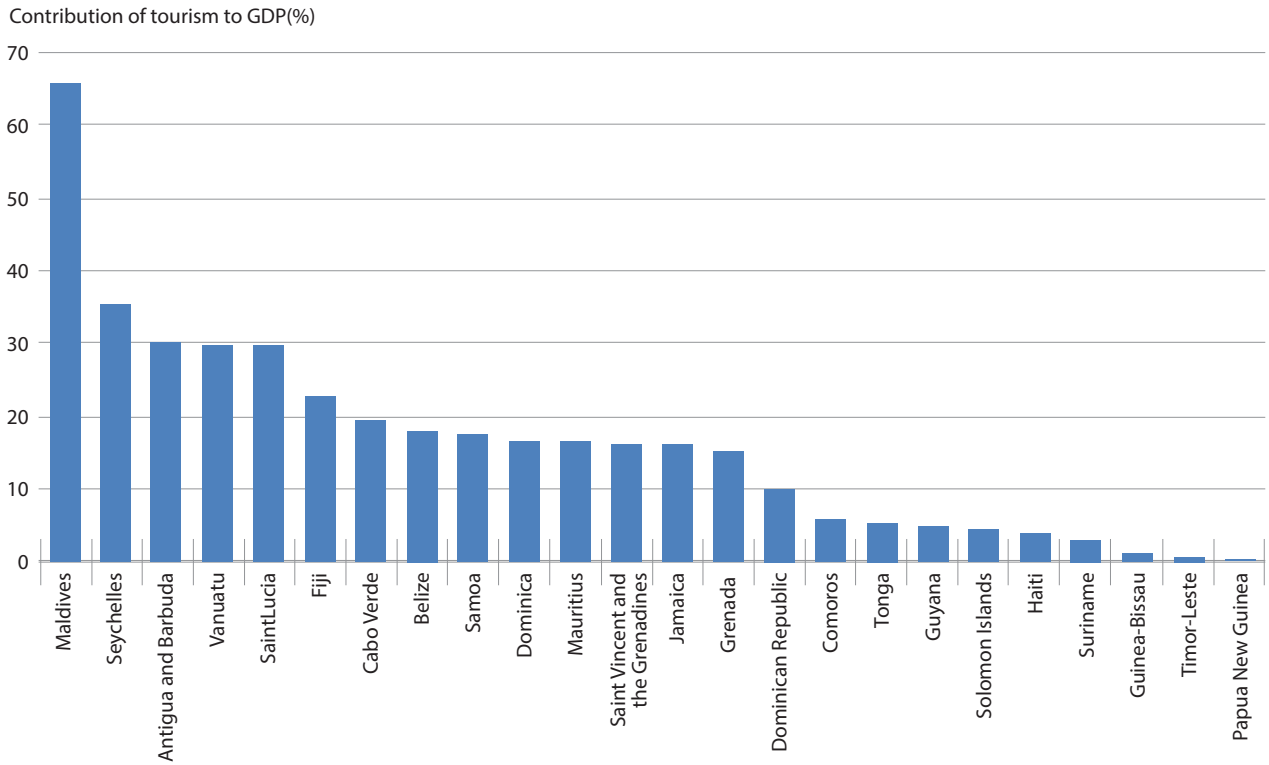
SIDS are taking significant steps to embark on sustainable ocean economies. They are developing national strategies and setting-up institutional arrangements. They are experimenting with pioneering financial innovations, such as the first blue bond issued by the Government of Seychelles, which has the backing of official guarantees and grant finance. While these are positive innovations, overall financing will need to be scaled up and be part of an integrated and strategic approach. For SIDS, who disproportionally suffer from the impacts of climate change and intensified natural disasters, building resilience to climate and natural disasters will be a critical component of the sustainable ocean economy. Development co-operation and Official Development Assistance (ODA) can play a critical role in this regard, but at present current ODA spending does not appropriately reflect the importance of the sustainable ocean economy. Of the USD 18.8 billion in concessional finance channelled to SIDS in 2012-15, only approximately USD 1.15 billion (6.11%) went to sectors relating to the ocean economy.

Developing countries can benefit from the sustainable ocean economy

The OECD project "Sustainable Ocean Economy for All: Harnessing benefits for developing countries" draws on OECD expertise in science technology and innovation, environmental protection and biodiversity, development finance and international co-operation. It offers new evidence for the urgent global challenge of developing sustainable ocean economies worldwide.

This work is an initial step designed to help developing countries address pressures on oceans and marine ecosystem services (e.g. pollution, over-fishing, climate change, habitat degradation) and chart a new course for tackling poverty, unemployment and food insecurity through sustainable development. It expands developing countries' access to the knowledge, innovations, and financial resources needed for promoting a sustainable ocean economy through original research and policy dialogue.

Figure 7. **Tourism represents about 20% of GDP for almost two-thirds of Small Island Developing States**

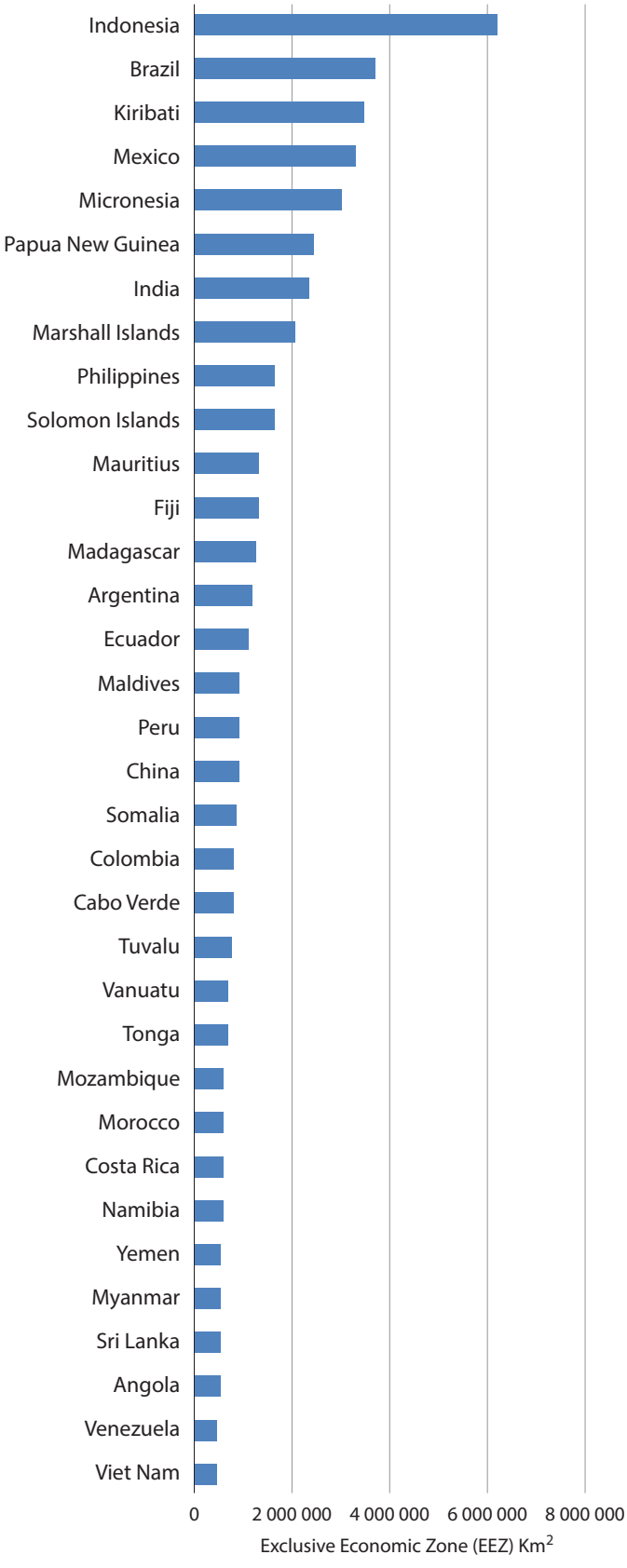


Source: Making Development Co-operation Work for Small Island Developing States (OECD, 2017). Adapted from UN World Tourism Organization (2016), Statistics database www2.unwto.org/content/data.

Deliverables for the "Sustainable Ocean Economy for All: Harnessing benefits for developing countries" project include:

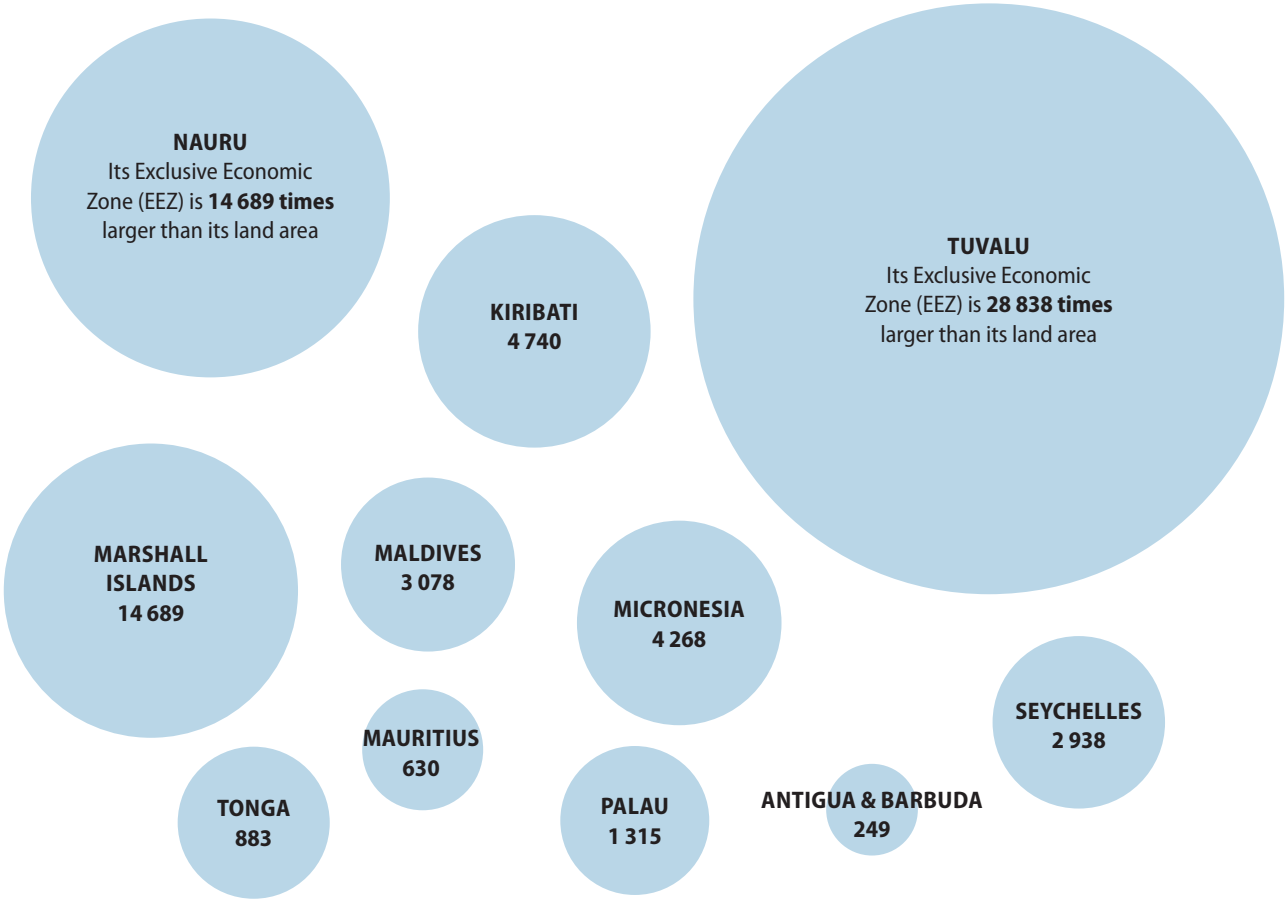
- A new OECD report with original analytical work on the global trends of the sustainable ocean economy across developing countries and dedicated policy recommendations;
- The first set of OECD multi-disciplinary country diagnostics on the ocean economy for selected developing countries;
- A new set of quantitative and qualitative indicators and policy recommendations to guide decision-makers in developing countries and donor countries alike in support of the development of sustainable ocean economies; and
- A series of international workshops to promote mutual learning within ocean-related communities and across stakeholder groups – ministries, agencies, academia, foundations, NGOs and the private sector.

Figure 8. **Developing countries with the largest marine area under national jurisdictions**



Source: based on statistical data from www.seaaroundus.org/data/#/eez

Figure 9. **Countries where national waters exceed land area**



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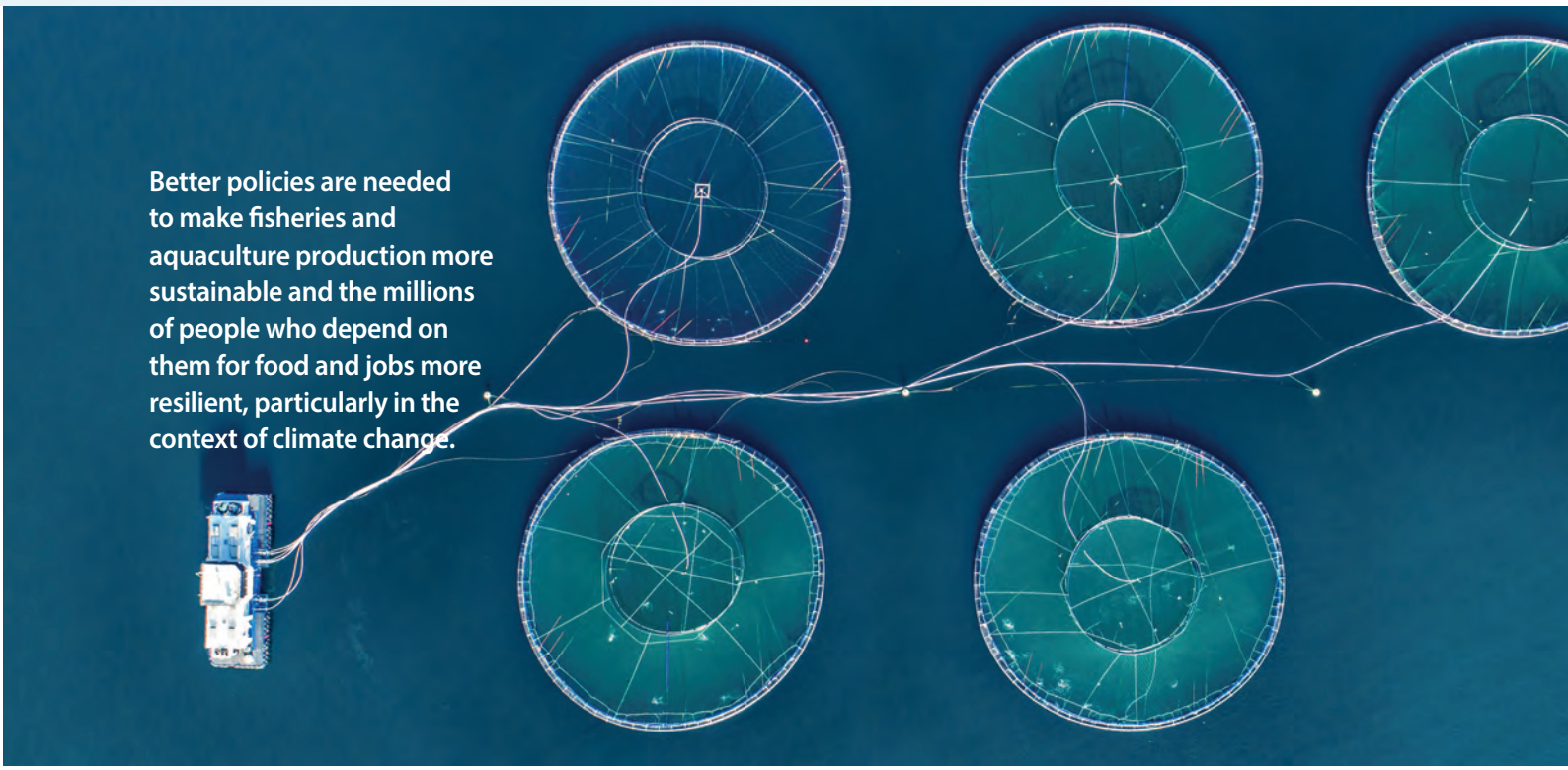


Better policies are needed to make fisheries and aquaculture production more sustainable and the millions of people who depend on them for food and jobs more resilient, particularly in the context of climate change.

Sustainable and resilient fisheries and aquaculture

Fisheries and aquaculture play a key role in the nutrition of hundreds of millions of people around the world every day. Following the widespread expansion of aquaculture production, particularly in Asia, nearly 60 million people work in the sector today, almost twice as many as in the early 1990s. In the OECD, over the last two decades, total seafood output value has increased by about a third, predominantly driven by strong growth in the value of aquaculture. Over the same period, the volume of wild fish harvests fell by about 30% because of declining stocks and fishing policies aimed at exploiting them more sustainably (Figure 10).

However, climate change, fishing pressure and pollution from various human activities are causing ocean acidification and declining biodiversity. Global fisheries could generate billions more in benefits if they were better managed. A significant share of the losses due to mismanagement is estimated to be caused by illegal, unreported and unregulated (IUU) fishing. A key obstacle to restoring the sustainability of resources globally, IUU fishing reduces the resources available to legal fishers, undermines governments' capacity to manage fish stocks sustainably and reduces public revenue.

OECD promotes better policies to ensure the future of seafood production and those who depend on it

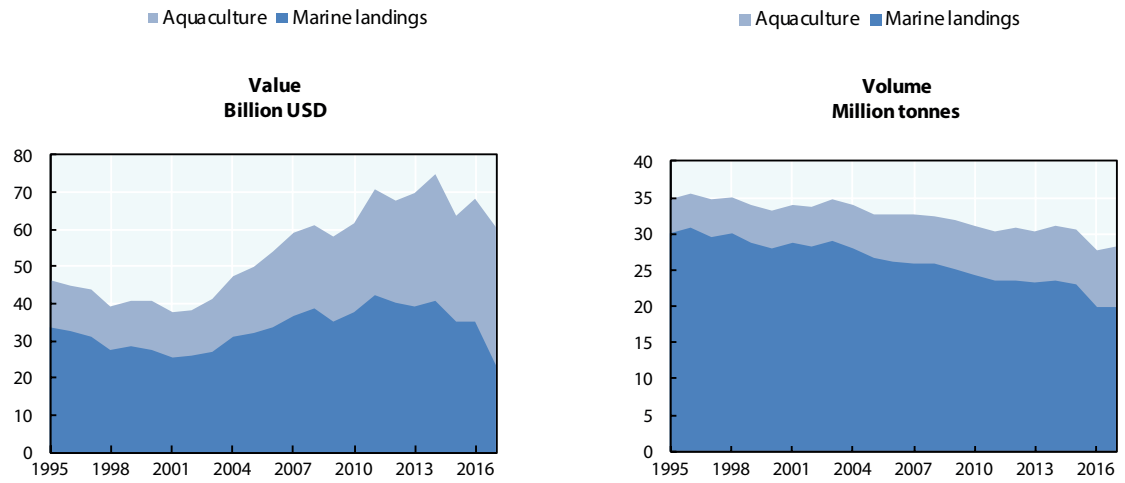
Governments are increasingly aware of the shortcomings of fisheries and aquaculture management frameworks, and that smarter regulations and new technologies are needed if sustainability and productivity are to be improved. However, achieving reform in fisheries and aquaculture policy can be difficult as a broad range of interests are at stake and it is often difficult and expensive to collect data on marine resources and ecosystems.

The OECD helps governments establish good policies and governance to achieve environmentally sound fisheries and sustainable aquaculture that support resilient communities, provide quality food and secure livelihoods. Our work contributes to a more robust evidence base for policy making and promotes a dialogue among and between authorities in charge of fisheries and aquaculture policies in OECD member countries and beyond.

Encourage the use of smart support policies

Recent work encourages dialogue on government support to the fisheries sector using the (FSE) database, which measures and describes fisheries support policies in a consistent and transparent way across all OECD member countries and important non-member fishing economies. This database is a unique resource to inform

Figure 10. **The share of aquaculture in OECD fish production by value has more than doubled in two decades, surpassing that of wild caught fish**



Note: Aquaculture volumes are expressed on a live weight basis; marine landings in landed weight. Volumes reported provide an indication of production magnitude and trend. Data may be heterogeneous and not directly comparable.

Source: OECD Fisheries Database.

negotiations on fisheries subsidies taking place at the World Trade Organization and to monitor progress towards achieving the United Nations Sustainable Development Goal number 14. The FSE database also provides a basis for users to investigate the impacts of fisheries support policies on resources and ecosystems as well as on jobs, incomes and value creation with a view to adjusting policies to better deliver the goals they were designed to meet.

The recent report Relative Effects of Fisheries Support Policies (Martini and Innes, 2018) suggests ways to better align the choice of support policies with stated objectives for the sector while minimising their impact on resources. For example, this work has shown that policies lowering the cost of inputs such as fuel or vessel construction and modernisation are among the most likely to provoke overfishing, overcapacity, and illegal, unreported and unregulated (IUU) fishing. At the same time they lead to less inclusive outcomes, favouring large fishers over small producers. In 2017, such policies accounted for 40% of the direct support to individuals or companies in the fisheries sector reported by the 27 OECD countries that participate in the FSE database. Re-directing support away from policies that create incentives to fish more intensely could have significant benefits for the environment, the sector's sustainability as well as for fishers' livelihoods. Further investing in science-based stock management and measures against IUU fishing could have a similar win-win impact. OECD analysis has shown that when an effective management system is in place (e.g. with limits on total allowable catch), support policies generally lead to more benefits for fishers and are less likely to encourage unsustainable fishing.

Implement strong frameworks to tackle illegal fishing

Two recent studies by the OECD, "Closing gaps in national regulations against IUU fishing" and "Intensifying the fight against IUU fishing at the regional level" help countries identify how to better address IUU fishing. With a suite of indicators, the reports investigate the extent to which governments meet their responsibilities in the fight against IUU fishing, and the extent to which Regional Fisheries Management Organisations (RFMOs) use best practices to support their member countries. Results show considerable progress in improving regulatory frameworks and enforcing legislation over the last decade (Figure 11), but also point to gaps that need to be addressed individually and collectively. Tailored recommendations are addressed to countries and RFMOs on how to achieve this. For example, in several countries, regulations and reporting requirements on fishing-related activities, such as transhipment of catch between vessels, need to be strengthened to levels comparable to those governing

fishing, while tougher sanctions should be applied and access to public support cut for fishers who do not abide by the law. At the regional level, RFMOs should publish more comprehensive lists of authorised and IUU fishing vessels and be better at recognising each other's lists. They should create strict and transparent sanctioning mechanisms for countries that fail to fulfil their obligations as RFMO members, and adopt catch documentation schemes that certify legal catches in a standardised way.

Promote science-based, inclusive policy making

The OECD is also working on enabling policy reforms in difficult contexts: where it takes time to rebuild fish stocks and thus enjoy the benefits of better policies; where data are difficult and expensive to collect; and where affected stakeholders need to be accompanied in transitions. The OECD report *Encouraging policy change for sustainable and resilient fisheries* helps governments find a successful pathway to reform through improved governance, stakeholder consultation, and mobilisation of scientific evidence and analysis. To inspire governments and stakeholders, we also share information on new policy developments and successful initiatives in our biannual *Review of Fisheries*.

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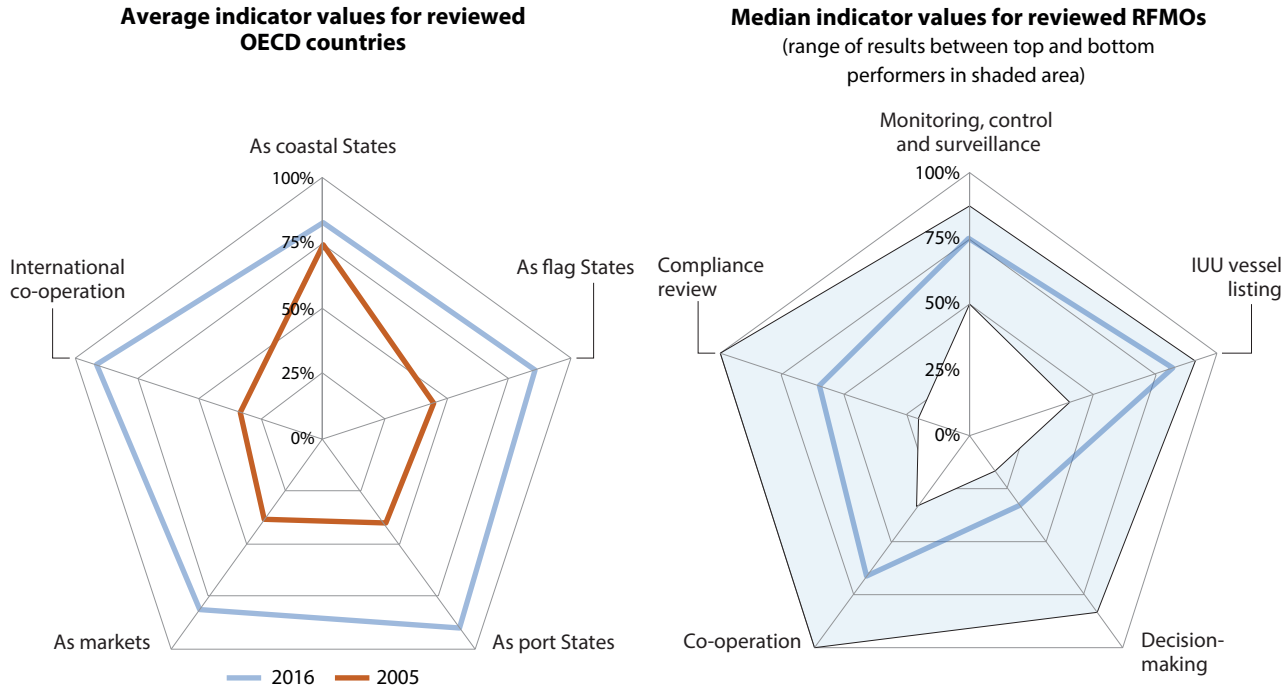
Figure 11. **OECD countries have shown considerable progress in fighting IUU fishing over the last decade, but gaps remain**



Source: Hutniczak et al. 2019a and Hutniczak et al. 2019b.

Ocean shipping and shipbuilding

The main transport mode for global trade is ocean shipping: around 90% of traded goods are transported by ship. As such, the oceans provide the main transport arteries for global trade. This comes with opportunities and challenges. The OECD is helping chart the course for more efficient and sustainable maritime transport.

Maritime transport forms part of a whole cluster of economic activities that can create economic value added. Efficient maritime transport can lower the costs for exports and as such enlarge markets. Maritime transport costs have decreased over the last decades because of containerisation and increased ship size. This has contributed to global outsourcing, which has increased global industrial specialisation patterns but also contributed to the decline of manufacturing employment in OECD countries. As such, the increase in maritime trade has had mixed effects. Many parts of the maritime supply chain have improved their efficiency, but potential for efficiency improvements exist for the interfaces between these stakeholders. Information sharing within the maritime logistics chain and digitalisation – both by private and public stakeholders - can help to further reduce inefficiencies and support smooth operations. The challenge is to make sure that digitalisation is not used as a business strategy by a few powerful players to lock in customers and reduce competition. Guidance to policy-makers is provided in "Information Sharing for Efficient Maritime Logistics" (ITF, 2018).

Navigate new policy challenges

Ocean shipping is also part of a larger maritime cluster in its position as buyer and customer. The shipping sector buys ships, so sustains the shipbuilding industry, and uses ports, terminals and logistics services. Such maritime clusters are considerable sources of economic value added, jobs and know-how in port-cities, as is illustrated in the paper "The Competitiveness of Global Port-Cities" (OECD, 2012). This know-how could be essential for new ocean-based activities, such as off-shore energy provision. The challenges for policy makers is to make sure that policy support to the shipping sector realises wider economic benefits and not simply facilitates a "race to the bottom" of flag states trying to attract shipping companies with tax incentives, subsidies – a tendency described in the 2019 ITF report "Maritime Subsidies" –

or less stringent norms and regulation. Developments in maritime transport – such as increased market concentration and ever larger ships – have consequences for public infrastructures, such as ports, for which public authorities and governments are responsible. These challenges and possible policy responses have been analysed in various ITF reports including "The Impact of Mega-Ships" (ITF, 2015), "The Impacts of Alliances in Container Shipping" (ITF, 2018) and "Container Shipping Europe: Data for the Evaluation of the EU Consortia Block Exemption Regulation" (ITF, 2019).

A mix of policy measures can be used to decarbonise maritime transport

Maritime transport is not only a source of prosperity but also of pollution. Global shipping is responsible for a substantial share of air emissions: approximately 30% of total global NOx emissions. These are emissions have been linked to thousands of premature deaths in coastal areas. A strategy for the reduction of GHG emissions from shipping has been adopted in 2018 by the International Maritime Organisation (IMO) and its member states. This strategy includes relative and absolute emission reduction targets, including the reduction of shipping emissions by at least 50% in 2050 relative to 2008 values. Much effort will be needed to reach international agreement on the measures needed to realise these targets.

The 2018 ITF report "Decarbonising Maritime Transport: Pathways to zero-carbon shipping by 2035" provides possible mitigation scenarios consisting of different mixes of measures, including operational measures (such as lower ship speeds) and technical measures (such are more energy efficient ship design) and the use of alternative fuels such as hydrogen and renewable energies such as wind energy. The successful implementation of such measures often depends on global regulations, but states can also stimulate reduction of GHG emissions from shipping with national policies and framework conditions. This is illustrated in "Decarbonising Maritime Transport: The case of Sweden"(ITF, 2018). Part of the solution for lowering air emissions could consist of financial incentives at the port level; an overview of these incentives and conditions under which these could be effective is provided in the 2018 report "Reducing Shipping GHG Emissions: Lessons from Port-based incentives" and the 2014 report "Shipping Emissions in Ports".

Clearer sailing ahead

Other environmental impacts from shipping include biodiversity impacts related to ballast water from ships and noise pollution having an impact on ocean wildlife. Global policy efforts have recently focused on sulphur and GHG emissions from ships and ballast water management. Important global regulation on sulphur emissions from shipping comes into force in 2020, with a global cap on the sulphur content in ship fuel. ITF provided recommendations on the implementation and enforcement of this regulation in its 2016 report "Reducing Sulphur Emissions from Ships: The Impact of International Regulation". Efforts could be intensified with respect to NOx and PM emissions.

With world ship completion on a declining trend since its 2011 peak, the challenges of over-capacity and over-supply have intensified for the shipbuilding industry. The shipbuilding industry is now faced with a major crisis linked to the COVID-19 pandemic. In the short term, shipbuilding is suffering from production disruptions linked to the closure of yards, supply shortage and delays in orders and deliveries. In the medium term, the shipbuilding industry is likely to face a demand shock with the expected drop in international trade that is the key driver of ship demand. Moreover, demand for passenger ships in particular cruise ships is also expected to be affected by the current crisis. Consequently, the pressure on governments to introduce or expand policies to assist ailing shipbuilders has further intensified. At the same time, there is a growing intensity of international and regional-level environmental regulation affecting the operation of vessels, inducing both challenges and opportunities for shipbuilders. These issues are made more complex by the growing weight of non-OECD economies in the shipbuilding market, and the existence of value chains linking shipbuilding and the wider maritime sector both within and across countries.

Against this backdrop, the OECD's key interest continues to be in establishing and maintaining normal competitive conditions in the shipbuilding market. This is the role of the OECD Council Working Party on Shipbuilding (WP6), which was created in 1966 with significant shipbuilding industries. Around this central tenet, policy transparency and improving the understanding and design of shipbuilding policies, are important objectives. The OECD remains the only international forum where national representatives and industry and union interests can come together to exchange views and conduct economic and policy analysis on all aspects of the shipbuilding sector. It provides a platform for peer dialogue, sharing of best practices and policy transparency. OECD work on shipbuilding policy in 2019 specifically addresses the key challenges of the global shipbuilding industry, including excess supply and excess capacity.

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Offshore wind has vast potential to spread around the world, capable of generating more than 18-times global electricity demand today.

Offshore wind power

Offshore wind is a rapidly maturing renewable energy technology that is poised to play an important role in future energy systems. In 2018, offshore wind provided just 0.3% of global electricity supply, but it is set to expand in the coming decades into a USD 1 trillion business, boosting efforts to decarbonise energy systems and reduce air pollution as it becomes a growing part of electricity supply. Turbines are growing in size and maximum output, which in turn is delivering major performance and cost improvements for offshore wind farms.

The IEA World Energy Outlook Special Report "Offshore Wind Outlook 2019" provides the most comprehensive analysis to date of the global outlook for offshore wind, its contributions to electricity systems and its role in clean energy transitions. The report gives a snapshot of where the offshore wind market, technology and related policies stand today – and maps out how they may develop through to 2040. It draws on a state-of-the-art geospatial analysis of the world's offshore wind resources and explores the implications of the technology's growth for global environmental goals and energy security.

Offshore wind has vast untapped potential

The global offshore wind market grew nearly 30% per year between 2010 and 2018, benefitting from rapid technology improvements. About 150 new offshore wind projects are in active development around the world. Europe in particular has fostered this ocean technology development, led by the United Kingdom, Germany and Denmark, but China added more capacity than any other country in 2018.

Yet today's offshore wind market doesn't even come close to tapping the full potential – with high-quality resources available in most major markets, offshore wind has the potential to generate more than 420 000 terawatt-hours (TWh) per year worldwide. This is more than 18 times global electricity demand today. The IEA undertook a detailed assessment of the technical potential for offshore wind development in collaboration with Imperial College London. An

interactive map is available online featuring offshore wind technical potential, classified by water depth and distance from shore, the latest offshore wind projects, and population density. The map is paired with a detailed description of the methodology used to produce this unique online resource.

Europe is the leader in offshore wind technology

The growth of the offshore wind industry has been fostered in European countries bordering the North Seas, where high quality wind resources and relatively shallow water have provided exceptionally good conditions to develop offshore wind technologies and bring them to market.

Policy support has helped the European Union reach nearly 20 gigawatts (GW) of offshore wind capacity by the end of 2018, more than 80% of the global total.Offshore wind is set for robust growth in the EU, with current policies aiming to multiply offshore wind capacity by four over the next decade.

Offshore wind is poised for worldwide growth

Alongside Europe, China has taken strides forward on offshore wind and now stands among the market leaders. In 2018, China added 1.6 GW of offshore wind capacity, the most of any country and nearly 40% of the global additions.

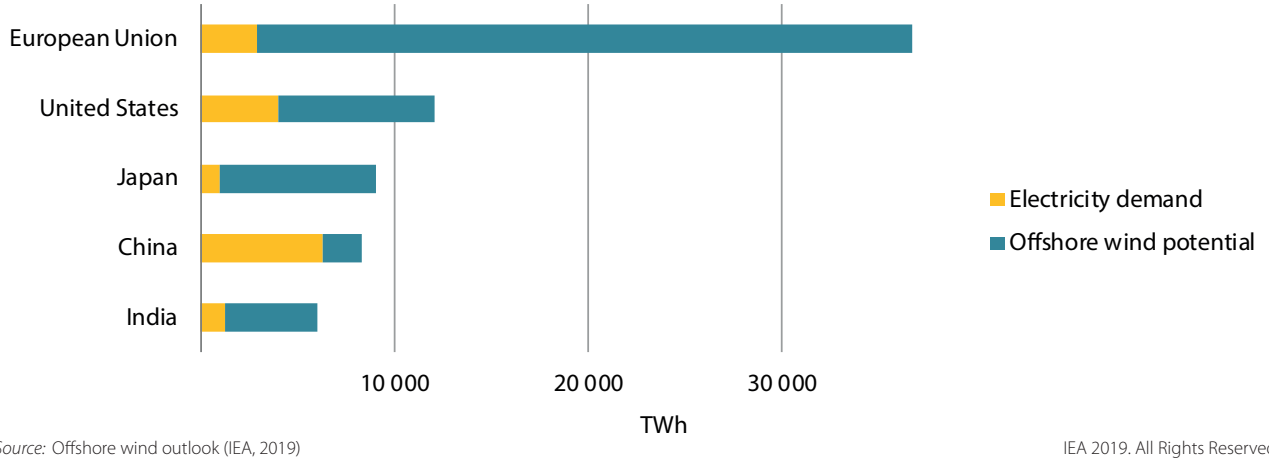
The global offshore wind market is set to expand significantly over the next two decades, growing by 13% per year in the IEA's Stated Policies Scenario (reflecting the impact of existing policy frameworks and announced policy intentions). Bolstered by policy targets and falling technology costs, global offshore wind capacity is projected to increase fifteen-fold to 2040, becoming a USD 1 trillion industry over the next two decades - matching capital spending on gas- and coal-fired capacity over the same period, and accounting for 10% of all investment in renewable electricity globally.

Europe is on track to remain the technology leader to 2040, but China closes the gap spurred by recent efforts to expand their construction capacities for offshore wind. In the United States, state-level targets set the course for rapid growth over the next decade.

India, Korea and Chinese Taipei also have ambitious targets, while other countries, including Japan and Canada, are laying the groundwork for future offshore wind development.

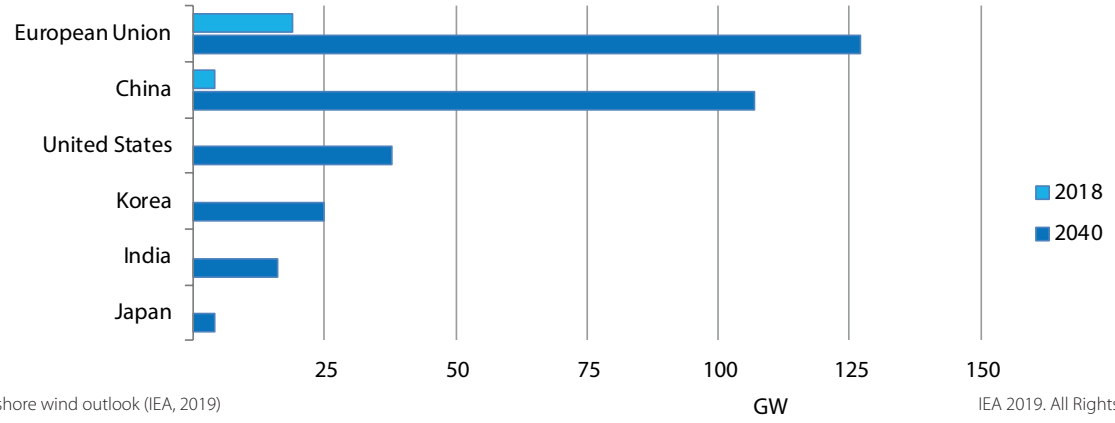
The OECD Clean Energy Finance and Investment Mobilisation (CEFIM) Programme supports emerging economies in Latin America, South and Southeast Asia accelerate finance and investments in clean energy including offshore wind. Working closely with some of the most promising emerging economies (Colombia, India and Viet Nam) for offshore wind development, the CEFIM programme aims to support the development of robust pipelines of bankable offshore wind projects. Analysis on derisking instruments used in the

Figure 12. **Offshore wind technical potential exceeds electricity demand (2018) in many major economies**



Source: Offshore wind outlook (IEA, 2019)

Figure 13. **Installed offshore wind capacity is set for rapid growth to 2040 under stated policies**



Source: Offshore wind outlook (IEA, 2019)

development of offshore wind projects and the role limited public finance can play to help leverage private funds (including from institutional investors) will be undertaken. The CEFIM programme aims to create a uniquely powerful collaboration between key domestic and international actors to accelerate the low-carbon transition.

Offshore wind is in a category of its own

Offshore wind is the only variable baseload power generation technology. New offshore wind projects have capacity factors of 40%-50%, as larger turbines and other technology improvements are helping to make the most of available wind resources.

At these levels, offshore wind matches the average capacity factors of efficient gas-fired power plants, coal-fired power plants in some regions, exceeds those of onshore wind and is about double those of solar photovoltaics (PV).

Offshore wind output varies according to the strength of the wind, but its hourly variability is lower than that of solar PV. Offshore wind typically fluctuates within a narrower band, up to 20% from hour-to-hour, than is the case for solar PV, up to 40% from hour-to-hour.

While decarbonising energy systems – for example through increased deployment of offshore wind power – is essential to meeting global climate commitments, continued monitoring is needed to better understand the cumulative impacts of wind farms on the ocean.

Offshore wind is set to be a USD 1 trillion industry over the next two decades, but the promise of growth hinges on government policies and industry strategies.

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Science, technology and innovation for a sustainable ocean economy

Exploitation of the ocean and its resources is more intensive than ever before, raising concerns about its physical capacity to cope. At the same time, scientific understanding of the ocean and its ecosystems – their properties and behaviour, their health and role in weather and climate change – is gradually improving, although many questions remain. Science, technology and innovation (STI) will play a crucial role in responsibly managing diverse ocean economies and responding effectively to the growing challenges associated with their development.

A new STI context for the ocean

Advances in the ocean economy go hand in hand with innovations in science and technology. Galvanised by digitalisation, the transformation of scientific research and innovation processes is speeding up in many parts of the world, in almost all disciplines and sectors of the economy (OECD, 2018). The adoption of disruptive technologies (e.g. artificial intelligence, big data, blockchain) is affecting academic research areas and business innovation cycles alike. The promotion of collaborative and open innovation is also changing the way researchers are training and working together. At the policy level, national research agendas are increasingly emphasising the need to tackle "grand challenges" in multiple economic, societal and environmental areas. In some countries, this new focus takes the shape of mission-oriented STI policies, steering the direction of science and technology towards ambitious and socially-relevant goals. The Sustainable Development Goals (SDGs) are also re-shaping some STI policy agendas.

The ocean STI landscape must also be considered in light of efforts to control the COVID-19 pandemic, especially in view of the forthcoming United Nations Decade for Ocean Science. The crisis could have enduring impacts on the international research landscape, with consequences on the re-prioritization of programmes, funding schemes and setting up research infrastructure. In this context, the importance of ocean science will need to remain at the forefront to face challenges posed by deteriorating ocean health, the changing climate and ocean economic activity. The OECD will continue to build the evidence base on effective STI strategies to support the recovery efforts.

The contribution of STI to realising more sustainable ocean economies is vast

Science is crucial to achieving global sustainability and adequate stewardship of the ocean, since it provides the ability to deepen our understanding of the ocean's resources and health, and better monitor and predict changes in its status (OECD, 2016).

Working with the ocean science community, the OECD is demonstrating how sustained ocean observations are an essential part of worldwide efforts to better understand the ocean and its functioning. These observing systems – fixed platforms, autonomous and drifting systems, submersible platforms, ships at sea, and remote observing systems such as satellites and aircraft – use increasingly efficient technologies and instruments to gather, store, transfer and process large volumes of ocean observation data. The data derived from such instruments are crucial for many different scientific communities and public and commercial users active in the ocean economy. They underpin a range of scientific research and critically support the safe, effective and sustainable use of the ocean environment and its resources. Developing and sustaining them requires significant public investment, the justification for which calls for rigorous assessment of the associated costs and benefits society.

The significance of ocean observations is growing, building on traditional scientific missions to provide evidence and increase our understanding of the ocean. But now these observations also contribute to monitoring the development of ocean economic activities and to improving integrated management strategies such as marine spatial planning. The general public also benefits, becoming both a user of these observations (e.g. checking water quality in popular coastal bathing spots) and a provider of data via original citizen science projects.

Many innovations are taking place in small- to large-scale ocean observing systems, and fresh approaches are needed to close gaps in knowledge surrounding the societal impacts of publicly funded ocean observation systems. Possible solutions highlighted by recent OECD

work in this area include improved tracking of users (both scientific and operational), the mapping of value chains, and improvements to methodologies through the development of international standards or guidelines to conduct socio-economic assessments (OECD, 2019).

In parallel, a string of enabling technologies promises to stimulate improvements in efficiency, productivity and cost structures in many ocean activities, from scientific research and ecosystem analysis to shipping, energy, fisheries and tourism. These technologies include imaging and physical sensors, satellite technologies, advanced materials, information and communication technology (ICT), big data analytics, autonomous systems, biotechnology, nanotechnology and subsea engineering.

New enabling technologies such as these appear set to contribute in important ways to the sustainable development of the ocean economy, not least by vastly improving data quality, data volumes, connectivity and communication from the depths of the sea, through the water column, and up to the surface for further transmission. Some companies, for example, are using blockchain and big data analytics applications in their port facilities and maritime supply chains. Shipping companies, logistics businesses, port operators and other maritime transport stakeholders are looking to more integrated services across the entire supply chain as a means of generating cost savings, greater efficiencies and improvements in quality of service. The prospects for achieving those benefits by getting the various relevant operations (administration, logistics, shipping, terminal and port) to work together more smoothly have been boosted by the advent of digital platform technologies. This has the potential for greening further some commercial operations, saving energy, fuel in transport and limiting pollution.

New ways of collaborating foster both scientific discovery and ocean economy innovation

Scientific discovery and successful innovation often require fresh thinking in the organisation and structure of the research process itself. The OECD is exploring ocean economy knowledge and innovation networks that bring together a diversity of players (public research institutes, large enterprises, small- and medium-sized enterprises, universities etc.). These flexibly-organised groups work on a range of scientific and technological innovations in many different sectors of the ocean economy (e.g. marine robotics and autonomous vehicles, aquaculture, marine renewable energy, biotechnologies, and offshore oil and gas). Such research and industry networks are springing up in many parts of the world in response to changes in the national and international ocean research environment, and leveraging their organisational and skill diversity to benefit their partners and research in the ocean economy more generally.

Exploring further how STI will contribute to sustainable ocean activities

As the launch of the United Nations' Decade of Ocean Science for Sustainable Development (2021-2030) approaches, there will be opportunities to work collectively on providing evidence on the different types of impacts from sustained investments in ocean science, technology and innovation. There are likely to be many challenges to come in developing sound and sustainable ocean economies. Effective mechanisms for fostering science, technology and innovation that encourage ocean economic activity while ensuring the conservation and sustainable use of the marine environment will become ever more crucial. The OECD stands ready to continue supporting the ocean community and beyond in these endeavours.

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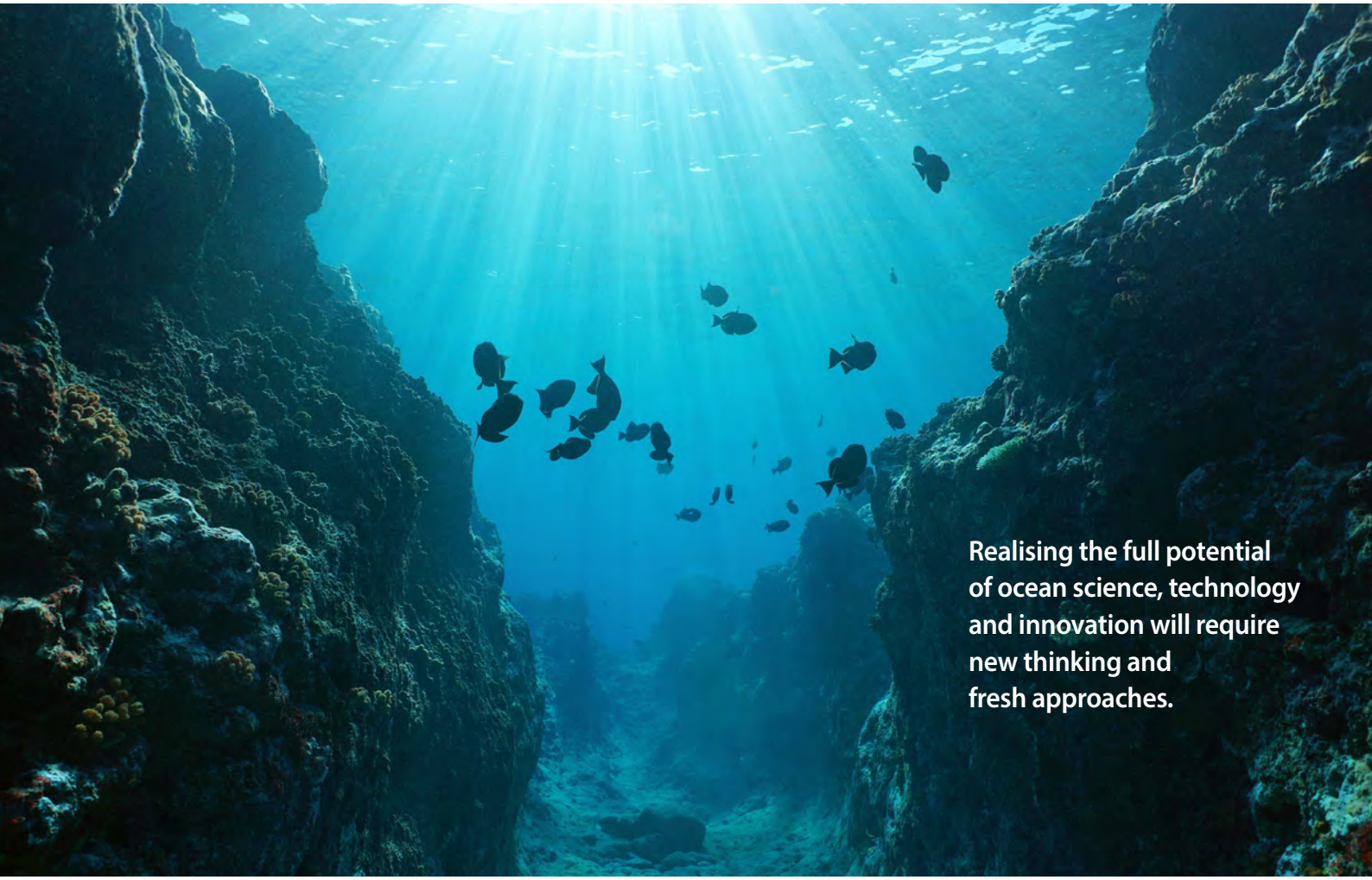
THE QUICK READ: *Rethinking Innovation for a Sustainable Ocean Economy*

New thinking and fresh approaches are required to meet the challenges of developing a truly sustainable ocean economy. This publication, building on the conclusions of the OECD report *The Ocean Economy in 2030*, advances on four objectives:

- Offering a forward-looking perspective on scientific and technological innovation across a range of marine and maritime applications, with a particular focus on some of the innovations already in the pipeline;
- Contributing to the growing body of evidence suggesting that, with the help of innovation, the development of economic activity in the ocean and sustainability of marine ecosystems can often go hand-in-hand with one another, and providing four in-depth case studies that illustrate the potential for generating such outcomes;
- Investigating the emergence of new forms of collaboration in the ocean economy among research communities in the public sector, the academic world and a diverse range of private-sector stakeholders, using the example of innovation networks that have sprung up in recent years around the world;
- Highlighting new approaches to measuring the ocean economy, notably by exploring the use of satellite accounts for its twin pillars – ocean-based economic activities and marine ecosystem services – and by examining ways to better measure the benefits that sustained ocean observations provide not only to science, but also to the economy and society more generally.

The original analyses conducted in this work recommend three priority areas for action: 1) encourage innovation that produces win-win outcomes for ocean business and the ocean environment; 2) seek ways to nourish the vitality of ocean economy innovation networks; and 3) support new initiatives to improve measurement of the ocean economy.



Financing and investment for a sustainable ocean economy

Overcoming the ocean health challenge, while meeting the needs of the billions who depend on the ocean for livelihoods, will require important changes in how finance flows to ocean-related economic activities. Growth in ocean investment, especially in times of recovery from economic crises, will not be sustainable in environmental and social terms by default. The characteristics of several ocean sectors – such as physical remoteness and challenging traceability – may instead mean that investment is more likely to flow to less sustainable activities, i.e those that are environmentally destructive and economically short-term. The challenge is therefore significant, requiring scaling up investment in sustainable ocean activities and reallocating capital away from harmful or unsustainable activities.

Defining and measuring "sustainable" ocean finance remains a challenge

The diversity of ocean economic sectors means that there are no simple answers to questions such as how much finance is already flowing to sustainable activities, how much is required to protect ocean health, and which instruments are best suited to scale up and reallocate finance. Evidence on global finance for the ocean from its various sources – private and public, domestic and international – is still scarce and scattered. It is currently not possible to have a comprehensive view of how much finance reaches ocean-based sectors and what percentage of that can be considered sustainable. Even defining what is "sustainable" varies across ocean sectors, meaning that the policy tools, regulation and financial instruments needed to make sustainable activities competitive and investable are also quite varied. Unlike climate change mitigation, there is no single metric or externality – such as a tonne of carbon dioxide equivalent – that can be priced or even easily defined.

Diverse ocean sectors require diverse approaches to financing

Some ocean industries are economically dependent on the natural capital of the ocean, such as wild-catch

fishing and marine tourism. Protecting and valuing that natural capital is therefore an important pillar of achieving sustainability for those sectors, so that it continues to provide economic opportunities in future. But that is only part of the picture. Other ocean industries are less reliant on ocean natural capital, but their operations can be harmful to it. These sectors, such as energy and shipping, generally require enhanced incentives and regulation to improve the investment case for sustainable practices. In addition, some land-based sectors that are physically remote from the ocean and not usually thought of as having any ocean link, can nonetheless have critical impacts on ocean health. These impacts – such as through nutrient run-off from agricultulture and plastic debris from waste management – require yet different policy approaches in those sectors.

To date, public funding has played a big part in ocean conservation and investment in sustainable ocean activities, both domestically and internationally through official development assistance and other concessional financing (see the following section). Some private sector "impact investors" have also become important players in recent years, because their investment criteria value sustainability impacts as well as financial returns. But to really move the needle on ocean health, governments must move beyond concessional and impact investing and create the conditions for sustainable ocean investments to attract fully commercial capital. This will require action on a number of fronts, including enhanced policy and regulation to realign incentives and deployment of a range of innovative financing instruments.

Governments can play a central role in making sustainable ocean finance competitive

From a financing perspective, the investability of sustainable ocean projects depends on the economic returns available from sustainable activities as well as on their real and perceived financial risks. Governments have a role to play on both dimensions. Policies are critical to ensure stable returns for sustainable activities, for example through economic instruments to create value, and better regulation, including enforcement and traceability, to penalise harmful or illegal activities.

On the risk side, many ocean sectors are inherently risky compared to their land-based counterparts, because the ocean is a harsh and often remote physical environment. This can make attracting finance for ocean investment difficult and costly, even before integrating the additional risk posed by some sustainable activities, for example due to new technology and business models. Here there are several roles for governments. Policy frameworks are again important, for example to ensure clear ownership of ocean assets, and improving the underlying investment climate, such as clear and stable rule of law. Governments can also act through judicious use of public funding as a risk mitigant to leverage private sector capital, including through various forms of blended finance.

Additionally, governments can support and encourage the creation of novel financing models including new debt instruments such as blue bonds and sustainability linked loans, new approaches to insurance for sustainable ocean activities and new sources of revenue linked to sustainability, such as carbon credits related to conservation of coastal ecosystems. Communicating on these actions is also important to build awareness in the mainstream financial sector, as many potential investors remain unaware of their portfolios' existing ocean impacts and unsure where potential investment opportunities lie, despite new awareness of the urgency of improving ocean health globally.

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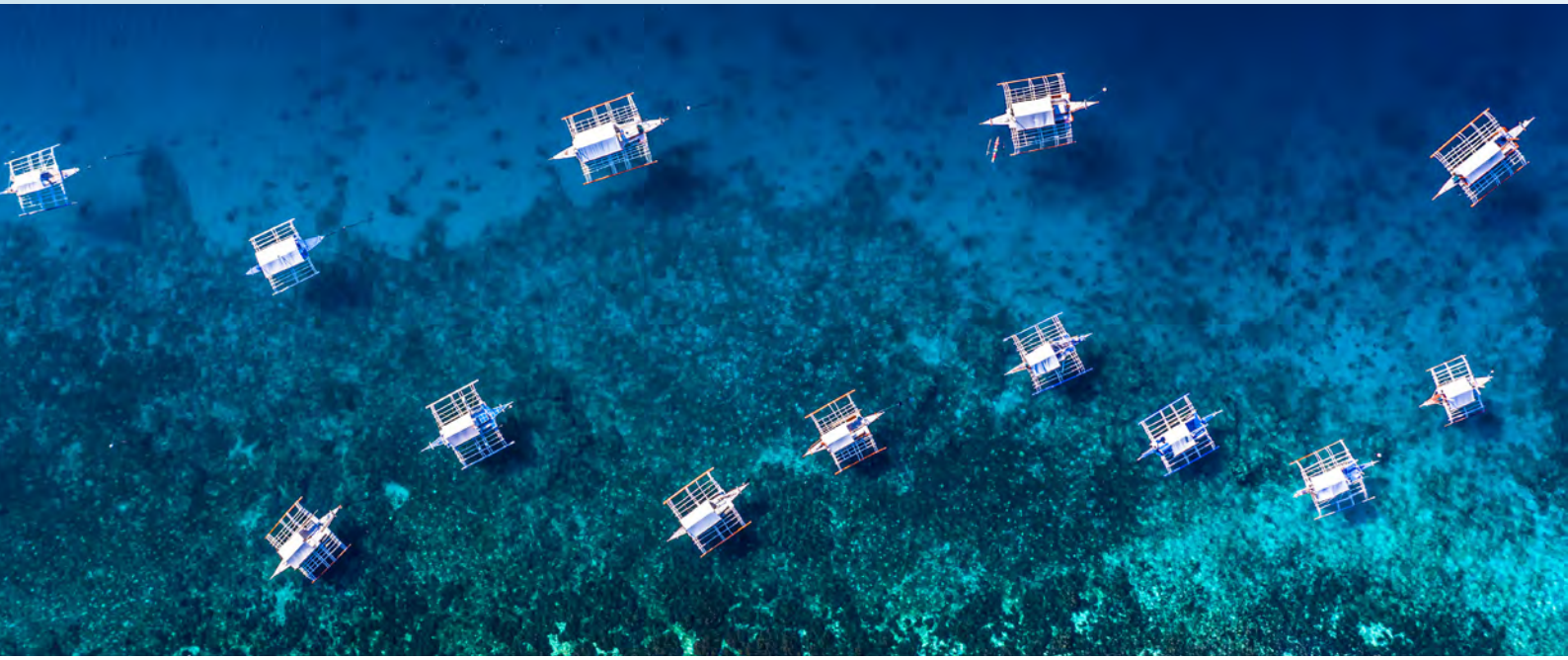


Development finance and effective co-operation for sustainable ocean economies

Development co-operation has a role to play to support developing countries turn both existing and emerging ocean-based sectors into catalysts for long-term, inclusive and sustainable development. For existing ocean-based sectors this largely means helping to seize opportunities to create new and better jobs, helping to correct the trends of financial leakages, economic exclusion and environmental degradation. For some new sectors, such as marine bio-technologies and extractive sectors, it largely means supporting countries to assess and balance risks and rewards and achieve sustainable use of resources that adequately integrate community interests and environmental concerns from the outset.

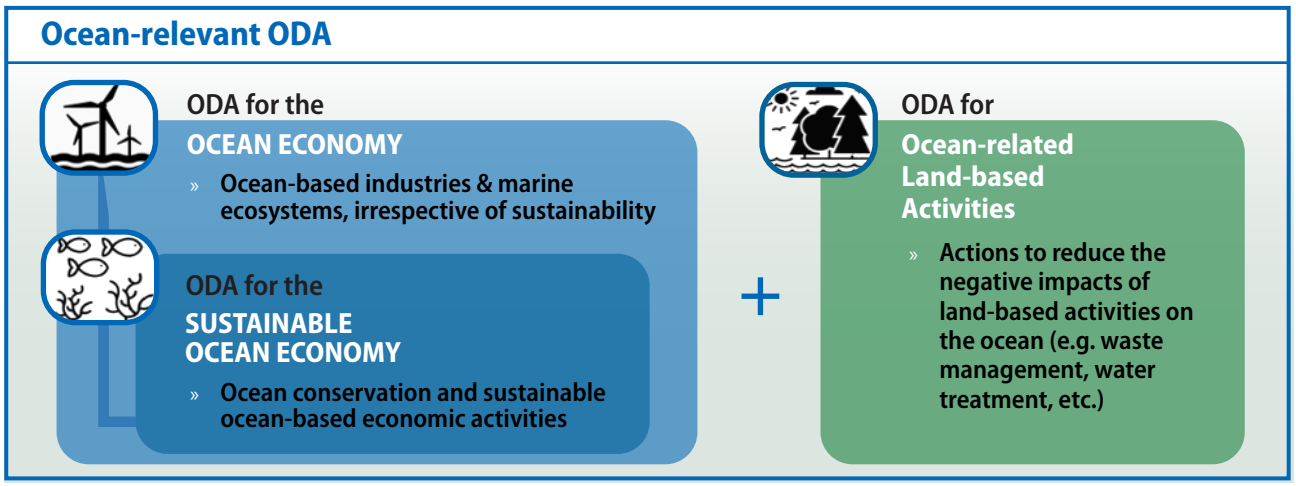
Several positive examples exist of development co-operation in support of more sustainable ocean economies. These include support for sustainable fisheries practices and enhanced seafood traceability; climate-resilient port infrastructure; assessing the potential of marine renewable energies and helping with the upfront costs of investment; closing the gap in financing marine protection and co-management schemes that reinforce synergies across sectors and support local ownership of resource management. Despite these good examples, there is a need for providers of development co-operation to understand the ocean economy more holistically and foster a broader mainstreaming of sustainability across ocean-based sectors.

Enhance transparency and impact of development finance

Evidence on global finance for the ocean from its various sources – private, public, domestic and international – is still scarce and scattered. It is currently not possible to have a comprehensive view of how much finance reaches ocean-based sectors and what percentage of that can be considered sustainable. To fill this gap, the OECD has started to quantify and track global development finance for the ocean, detailing its scope, sources and destinations, and providing estimates of what share is sustainable. Development finance estimates are also produced for funding towards land-based activities that reduce negative impacts on ocean (e.g. waste management and water treatment).

Better tracking is the first step towards better use and impact of development finance for sustainable ocean economies. Quantifying and monitoring development finance for the ocean is critical to obtain a clear picture of current trends and progress towards greater ocean sustainability. It increases the transparency and visibility of relevant development finance flows and activities. It is a prerequisite for understanding what works and what does not, contributing to foster greater effectiveness and impact of these flows. For Official Development Assistance (ODA), OECD has developed three main indicators to track ocean-relevant finance (Figure 14).

Figure 14. **OECD's key indicators for tracking ocean-relevant Official Development Assistance (ODA)**



Development finance can catalyse private finance towards sustainability

ODA can help tilt finance towards sustainability and indeed is increasingly being used catalytically to leverage private finance towards the conservation and sustainable use of the ocean. Development partners are using development finance and technical assistance to do this in two main ways: (i) through blended finance arrangements that use standard grants, guarantees, and other instruments; and (ii) through the development of a range of new financial products, such as blue bonds, debt-for-nature swaps, and insurance schemes. For instance, grants and guarantees from development partners were critical to structure the first Blue Bond (Seychelles), which allowed the country to harness capital market resources for marine conservation and sustainable ocean-based activities.

New OECD work in this area quantifies private finance mobilised through ODA, detailing the range of leveraging instruments used. It also maps new financial instruments developed through development co-operation and examines key challenges and opportunities for scaling them up in developing countries.

New development co-operation schemes can support ocean-related economic activity

Development co-operation needs to test and implement new ideas and approaches to be able to sustainably and effectively support developing countries face the new opportunities and challenges from the expanding economic activity in the ocean. Some emerging sectors could generate revenue for developing countries in the short term, but financial gains may be highly concentrated and difficult to reconcile with inclusive development. Destructive environmental impacts can be long-lasting and extend well beyond national borders with global consequences on basic ocean ecosystem functions. New international development schemes could provide support to individual developing countries for valorising or enhancing ocean ecosystem services, for instance through the creation of no-take zones to improve the replenishment rates of in-shore fish stocks and blue carbon projects to recognise and protect the carbon sequestration potential of certain ocean ecosystems like kelp forests, sea-grass beds and mangroves. New development co-operation schemes could also aim to strengthen developing countries' expertise and negotiating skills for new markets. Support for achieving fair commercial deals and concessions would be particularly relevant in a time when ocean resources are becoming more valuable and increasingly up for commercial exploitation.

KEY PUBLICATIONS

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OECD (2018), *Making Development Co-operation Work for Small Island Developing States*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264287648-en.

OECD/The World Bank (2016), *Climate and Disaster Resilience Financing in Small Island Developing States*, OECD Publishing, Paris, https://doi.org/10.1787/9789264266919-en.

KEY WEBSITE

www.oecd.org/dac/financing-sustainable-development/development-finance-topics/small-island-developing-states.htm

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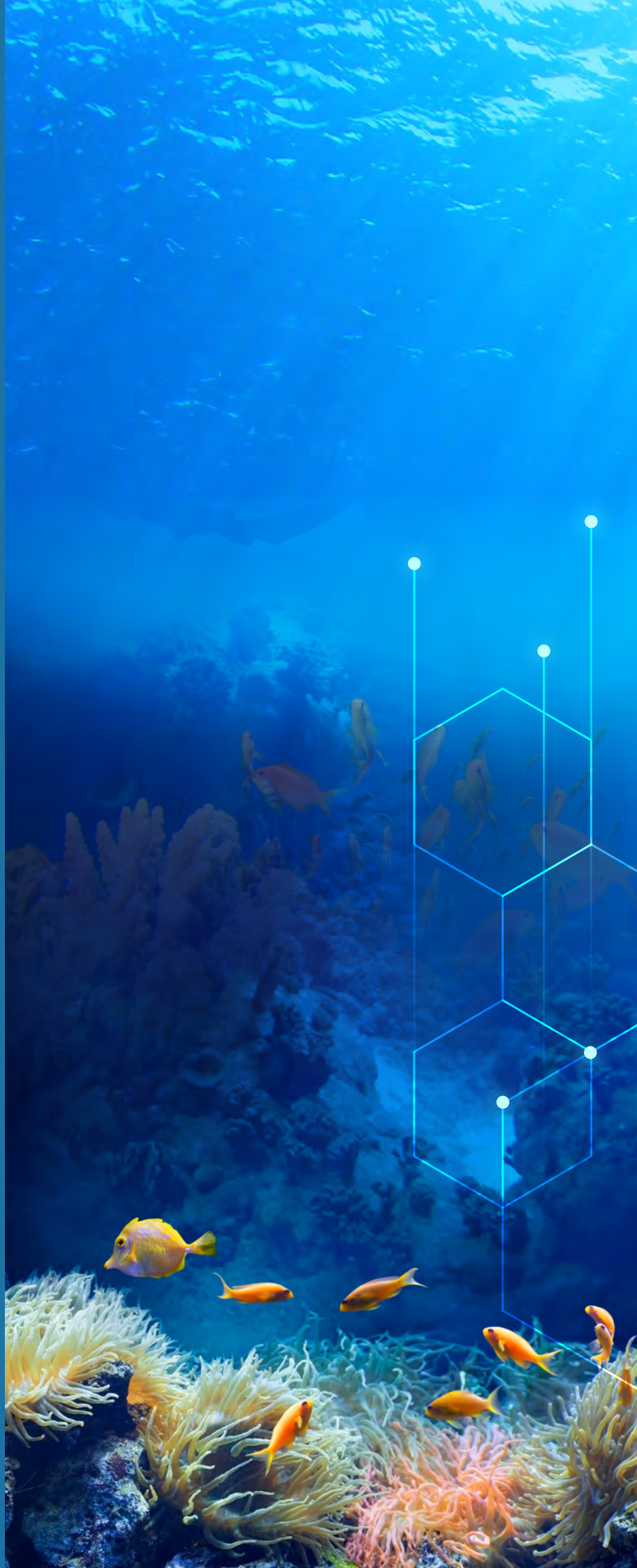

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