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

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BETTER POLICIES FOR BETTER LIVES

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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, the OECD projected a doubling of the ocean economy from 2010 to 2030, to reach USD 3 trillion and employ 40 million people.

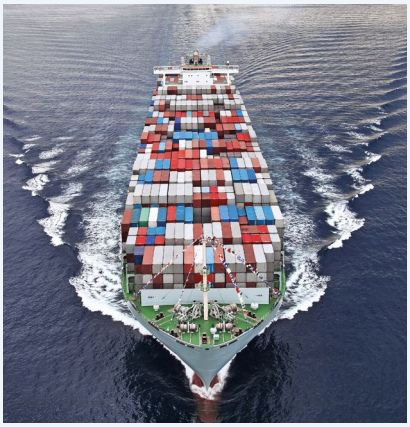
We must manage the ocean well, use its resources sustainably and reduce environmental pressures to realise the full potential of the ocean economy. The ocean is under immense pressure from a wide range of human activities and this will increase unless governments take bold action to ensure the protection 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 on Biological Diversity, 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 ocean conservation and sustainable use
- Supporting governments in curtailing plastics pollution, increasing recycling rates, and managing other types of ocean pollution
- Providing guidance on climate change 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
- 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?

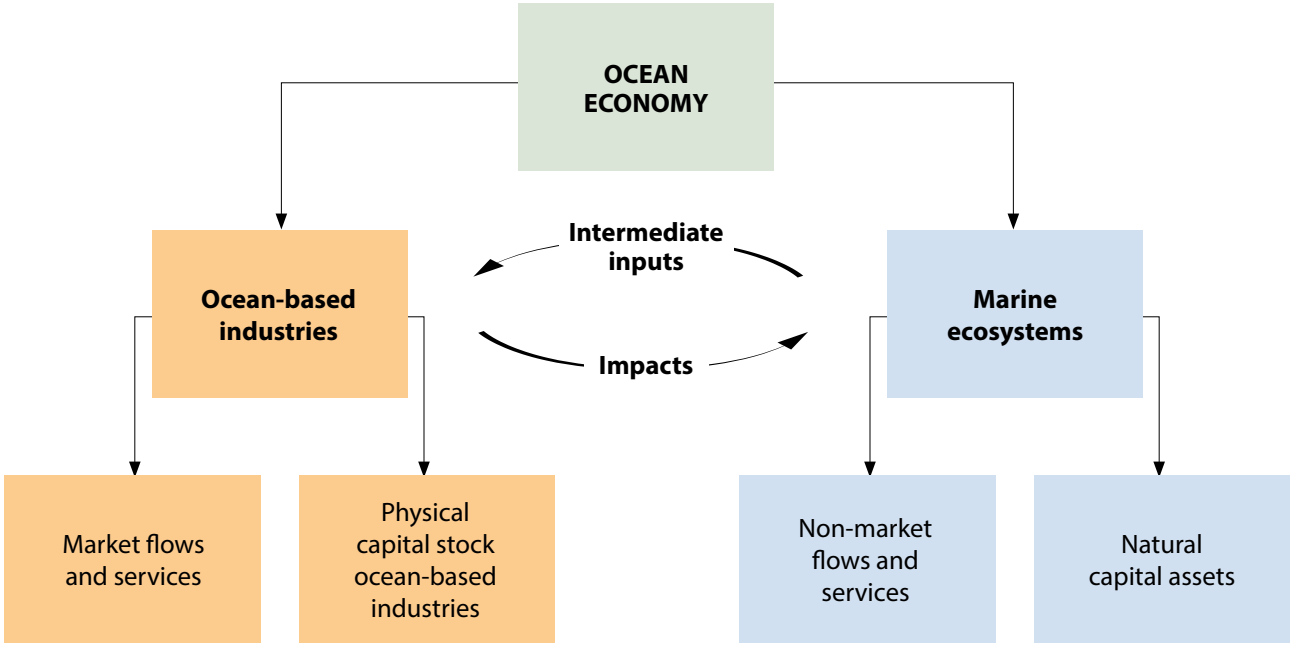
The ocean economy is defined by the OECD as the sum of the economic activities of ocean-based industries, together with the assets, goods and services provided by marine ecosystems (OECD, 2016). These two pillars are interdependent: much activity associated with ocean-based industry is derived from marine 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, 2021a; OECD 2020, 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).

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.

After two years of Covid-19 crisis, ocean economic activities are growing again

Before the COVID-19 crisis, 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.

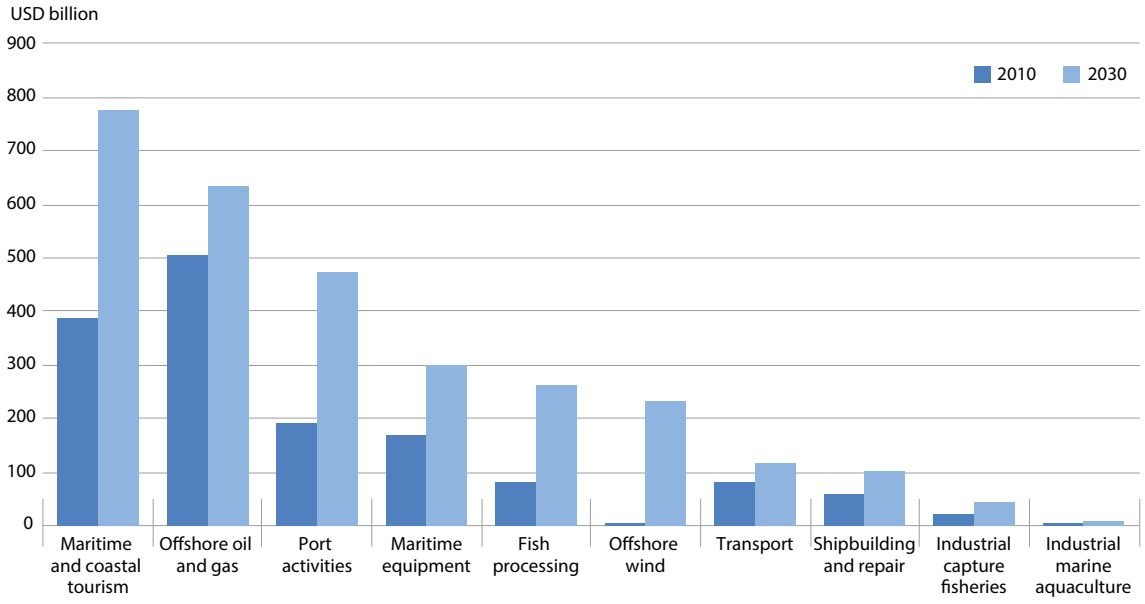
Since such analysis was conducted, governments have necessarily taken drastic action in response to the COVID-19 pandemic. Many ocean activities, not least those at the heart of the global trade and transportation system, were affected by measures to control the spread of the disease and the associated economic effects were major. Although economic activity broadly slowed down and for some sectors (e.g. tourism) some years may pass before pre-crisis levels are reached again, 2021 saw a renewed and even stronger growth of many ocean-based industries, with ever more impacts on the ocean environment (OECD, 2021a).

Many of the drivers associated with growth in the ocean economy remain. For instance, long-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 still consider economic stimulus strategies to face the post-COVID-19 crisis and growing geopolitical uncertainties.

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, 2021b; 2021c; OECD, 2020). The current United Nations Decades on Ocean Science for Sustainable Development and on Ecosystems Restoration provide opportunities to engage further the international community. The OECD supports these efforts, particularly by providing evidence on the importance of ocean data and observations for sustainable management (2021c).

Looking ahead and building on its foresight expertise, the OECD is launching in 2022 a new global exercise on the future of the ocean economy, which will revisit key shaping forces and provide new data projections on the ocean economy to 2045.

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; 2021a):

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 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. Based on new practical concepts and definitions, the OECD is currently developing with national stakeholders an experimental OECD satellite accounts on ocean economic activities to improve international comparability and as a building block to a future broader ocean account, linking eventually to environmental data (OECD, 2021a).

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 (OECD, 2021a). As the knowledge base on marine ecosystems' accounting builds (2021b), 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. The OECD already contributes actively to international discussions on the concepts of future broad ocean accounts (e.g. "SEEA Ocean" Working Group under the United Nations).

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** (http://oe.cd/ds/ocean) 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.

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www.oecd.org/sti/inno/ocean-economy
http://oe.cd/ds/ocean
http://oe.cd/env-glance
www.oecd.org/ocean

CONTACTS

Ocean economy
Claire Jolly – *Claire.Jolly@oecd.org*
Sustainable ocean economy database
Ivan Haščič – *Ivan.Hascic@oecd.org*

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

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 Targets of the Post-2020 Global Biodiversity Framework 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 were one of the few Aichi Biodiversity Targets (under the CBD) and SDG 14 targets that were 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.

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.

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

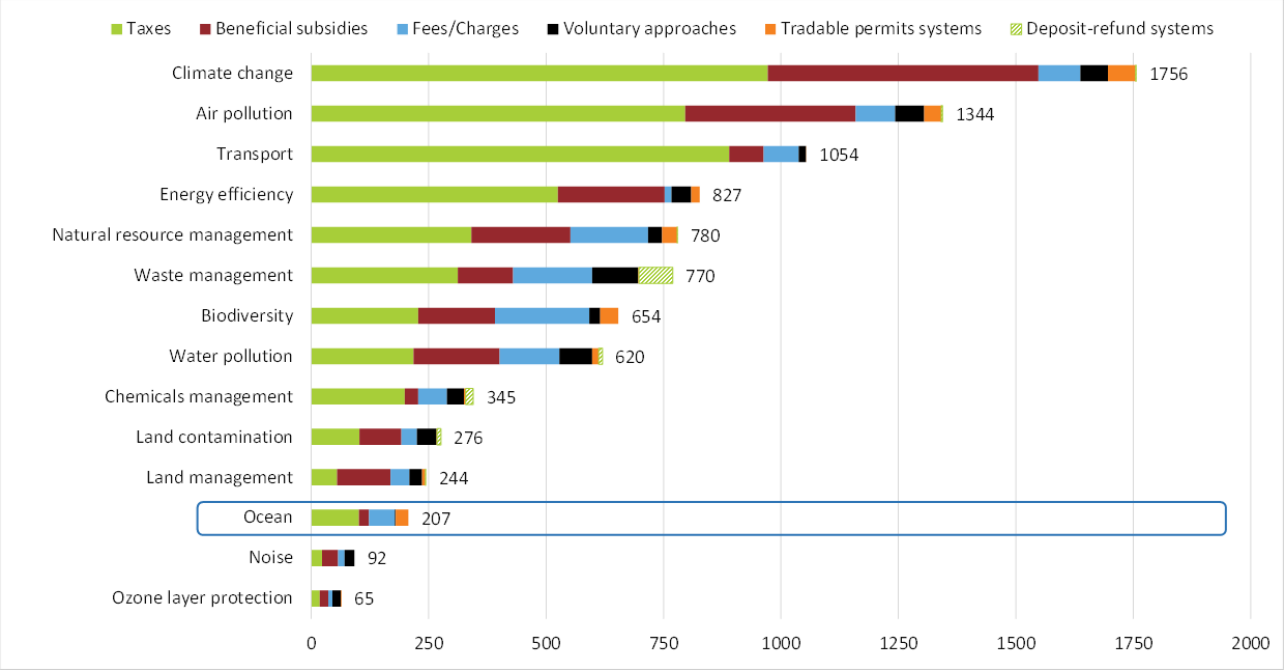
and environmental interests, devising targeted measures to address potential impacts on competitiveness and income distribution, and building a robust evidence base to support reform and provide resistance to pressure from vested interests.

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 more than 120 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 and targets under the CBD, 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 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.

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



Note: Based on 124 countries reporting to the database. Multiple tags per instrument are possible, so instruments can be included more than once. Only active instruments are shown; discontinued instruments are excluded.
Source: OECD Policy Instruments for the Environment (PINE) database, https://pinedatabase.oecd.org, accessed on 5 May 2022.

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OECD (2021), "Biodiversity, natural capital and the economy: A policy guide for finance, economic and environment ministers", *OECD Environment Policy Papers*, No. 26, OECD Publishing, Paris, https://doi.org/10.1787/1a1ae114-en.

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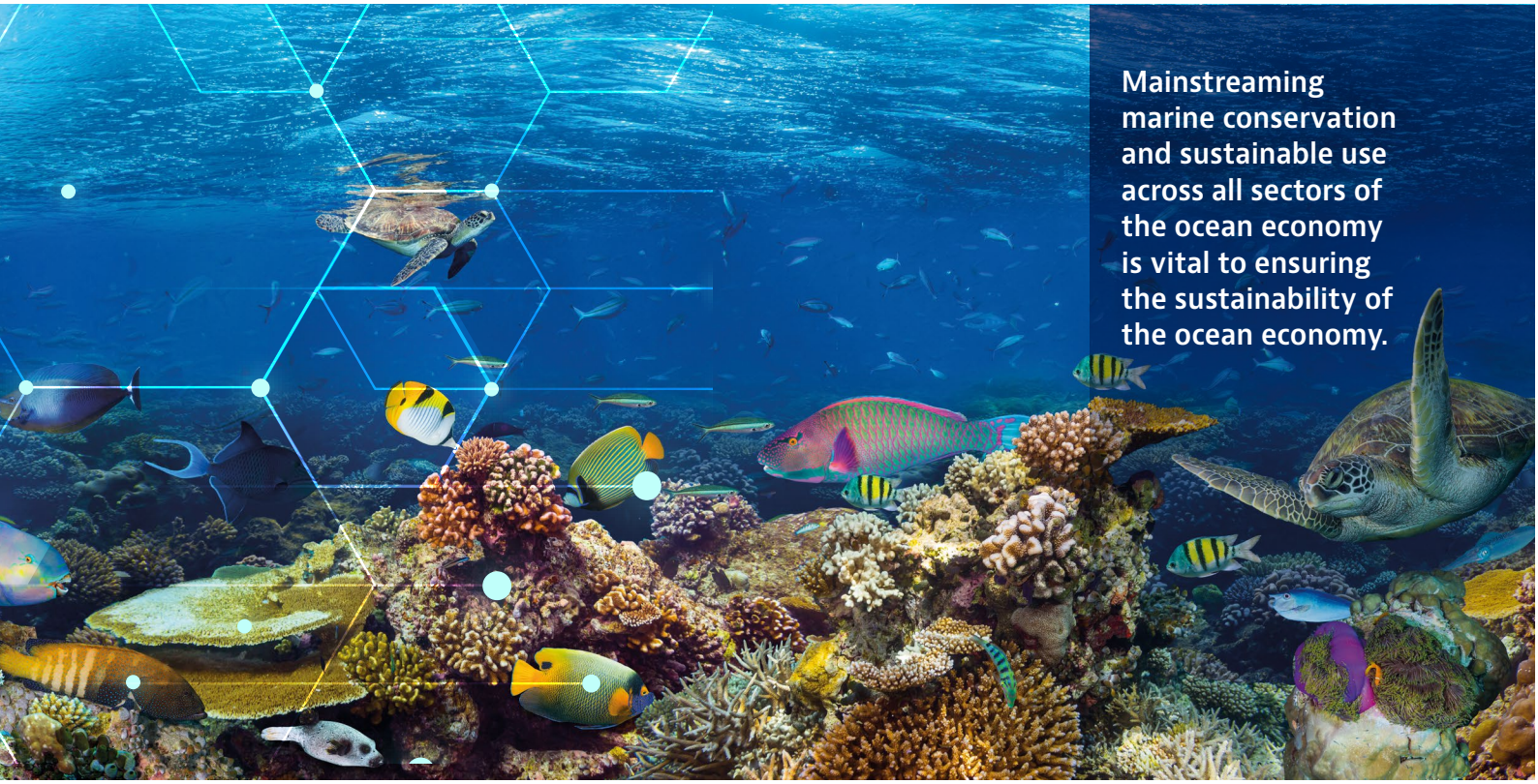
KEY WEBSITES

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

CONTACT

Katia Karousakis – *Katia.Karousakis@oecd.org*



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.

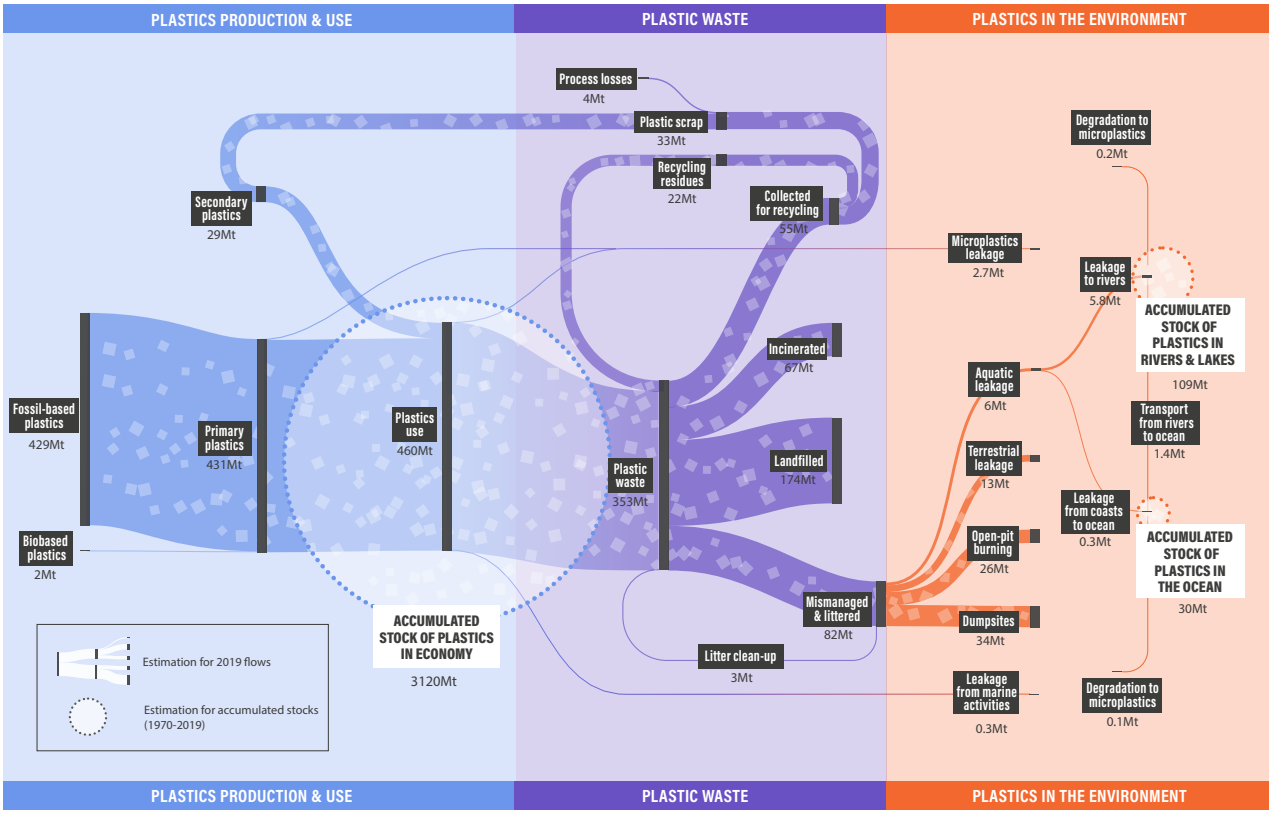
Plastic leakage is substantial and affects ocean ecosystems

The OECD's *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options* found that globally, the annual production of plastics has doubled, soaring from 234 million tonnes (Mt) in 2000 to 460 Mt in 2019 and that plastic waste has more than doubled, from 156 Mt in 2000 to 353 Mt in 2019. After taking into account losses during recycling, only 9% of plastic waste was ultimately recycled, while 19% was incinerated and almost 50% went to sanitary landfills. The remaining 22% was disposed of in uncontrolled dumpsites, burned in open pits or leaked into the environment.

In 2019 alone, 22 Mt of plastic materials leaked into the environment. Macroplastics account for 88% of plastic leakage, mainly resulting from inadequate collection and disposal, but also from marine activities. Microplastics, polymers with a diameter smaller than 5 mm and potentially high effects for ecosystems and human health, account for the remaining 12%.

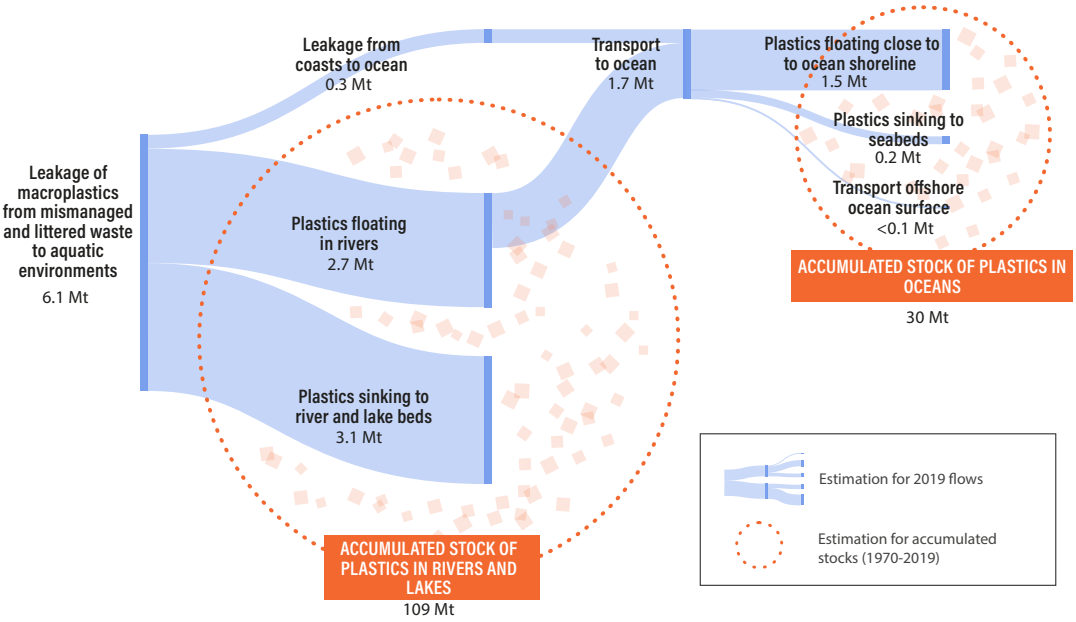
In 2019, 6.1 Mt of plastic waste leaked into rivers, lakes and the ocean. Over the years, significant stocks of plastics have already accumulated in aquatic environments, with 109 Mt of plastics accumulated in rivers, and 30 Mt in the ocean. The build-up of plastics in rivers and the slow transport downstream implies that leakage into the ocean will continue for decades to come even if mismanaged plastic waste was significantly reduced. Furthermore, cleaning up these plastics is becoming more difficult and costly as plastics fragment into ever smaller particles.

Figure 4. **Globally, 22 Mt plastic materials leaked into the environment in 2019**



Source: OECD (2022), Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options, OECD Publishing, Paris, https://dx.doi.org/10.1787/de747aef-en.

Figure 5. **Rivers accumulate leaked plastics and carry them to the ocean**



Source: OECD (2022), Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options, OECD Publishing, Paris, https://dx.doi.org/10.1787/de747aef-en

Critical levers to reduce the environmental impact of plastics

The *Global Plastics Outlook* (OECD, 2022) identifies four key levers for "bending the plastic curve":

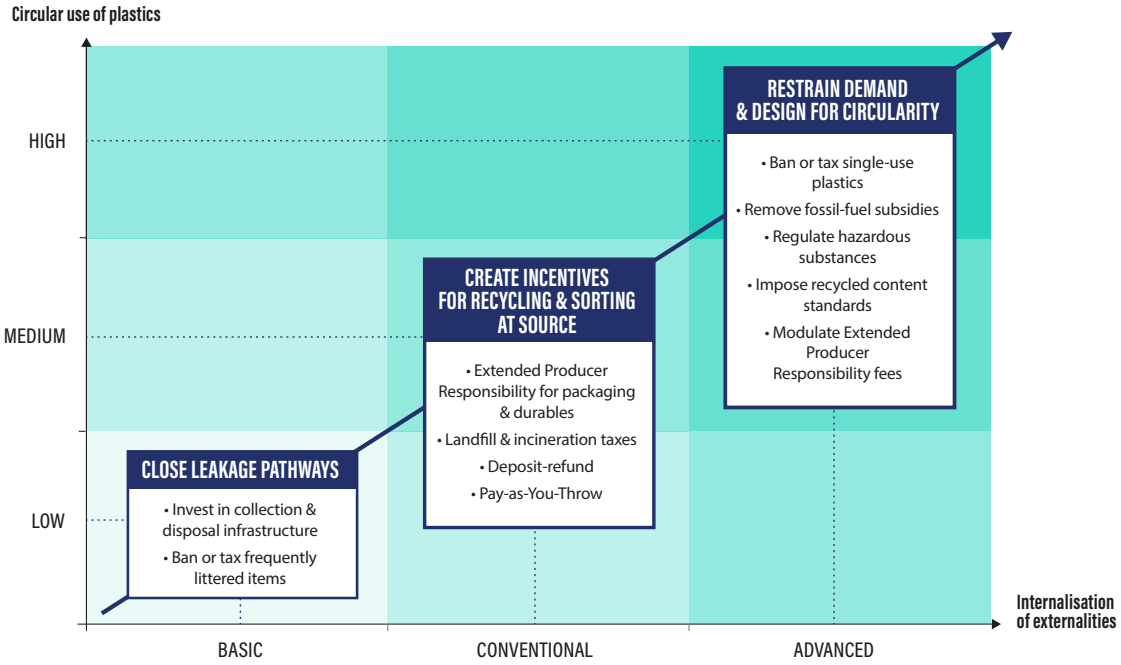
- **Develop recycled plastics market by combining push and pull policies.** While global production of secondary plastics from recycling has more than quadrupled in the last two decades, they are still only 6% of the total feedstock. Since secondary plastics are mainly considered substitutes for primary plastics, rather than a valuable resource in their own right, the secondary plastics market remains small and vulnerable. Some countries have successfully strengthened their markets by "pushing" secondary plastics supply – for example, through extended producer responsibility schemes – as well as "pulling" demand via recycled content targets. The recent decoupling of prices for primary and secondary polyethylene terephthalate (PET) in Europe and increasing innovation in recycling technologies are positive signs that the combination of these policies is working.
- **Boost innovation for a more circular plastics lifecycle.** Innovation can deliver significant environmental benefits – by reducing the amount of primary plastics needed, prolonging the useful life of products and facilitating recycling. This report shows that patented environmental plastics technologies increased more than threefold between 1990 and 2017. Yet circular plastics innovation makes up only 1.2% of all plastics-related innovation. More ambitious policies are needed, including a combination of investments in innovation and interventions aimed at increasing demand for circular solutions while restraining plastics consumption overall.
- **Strengthen the ambition of domestic public policies.** Public policies are a key lever for reducing the environmental consequences of plastics use. However, the current plastics policy landscape is fragmented and can be strengthened significantly. A larger rollout of well-known economic instruments such as Extended Producer Responsibility schemes for packaging and durables, landfill taxes, deposit-refund and Pay-as-You-Throw system, is needed to improve recycling rates and reduce leakage. Moreover, upstream policy instruments, such as recycled content targets and plastics taxes are emerging as

innovative tools to restrain consumption and incentivise design for circularity. The impact of these instruments could be improved considerably by extending coverage to more product types and more countries. To make the lifecycle of plastics more circular and reduce leakage, a policy roadmap for countries is proposed with three increasingly ambitious phases.

- *Close leakage pathways*. Build sanitary waste management infrastructure, organise waste collection and structurally reduce plastics littering by enlarging the scope of anti-littering policies (bans or taxes of frequently littered items) and enhancing implementation of legislation.
- *Create incentives for recycling and enhance sorting at source*. The required measures include extended producer responsibility (EPR) schemes, landfill taxes and incineration taxes, as well as deposit-refund and pay-as-you-throw schemes.
- *Restrain demand and optimise design to make plastic value chains more circular and recycled plastics more price competitive*. Instruments such as plastics taxes and recycled content targets can create financial incentives to reduce use and foster circularity. Their impact could be improved considerably by extending them to more product types and more countries. Similarly, chemicals management policies are important tools that can help improve the design of products and materials.

- **Strengthen international co-operation to make plastics value chains more circular and achieve net zero plastic leakage.** With mismanaged waste a widespread problem, especially in developing countries, major investments in basic waste management infrastructure are needed. To finance the required estimated costs of EUR 25 billion a year in low and middle-income countries (Soós, Whiteman and Gavgas, 2022)., all available sources of funding will need to be mobilised, including official development assistance which currently covers only 2% of the financing needs. Efficient use of such investments will also require effective legal frameworks to enforce disposal obligations.

Figure 6. **A policy roadmap for a more circular use of plastics use can involve a stepped approach**



Source: OECD (2022), Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options, OECD Publishing, Paris, https://dx.doi.org/10.1787/de747aef-en

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.

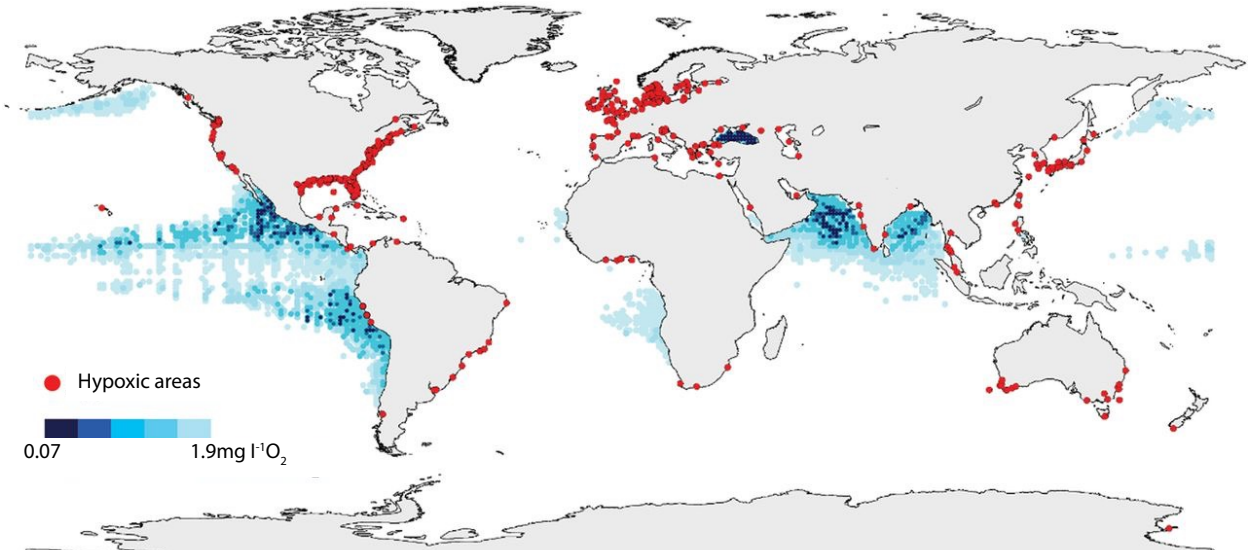
Figure 4 shows coastal and ocean sites where anthropogenic nutrients, such as nitrogen from fertilisers and livestock manure, have exacerbated or caused low oxygen levels (shaded blue areas), leading to the formation of dead zones (red dots). The number and size of ocean dead zones has doubled each decade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

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.

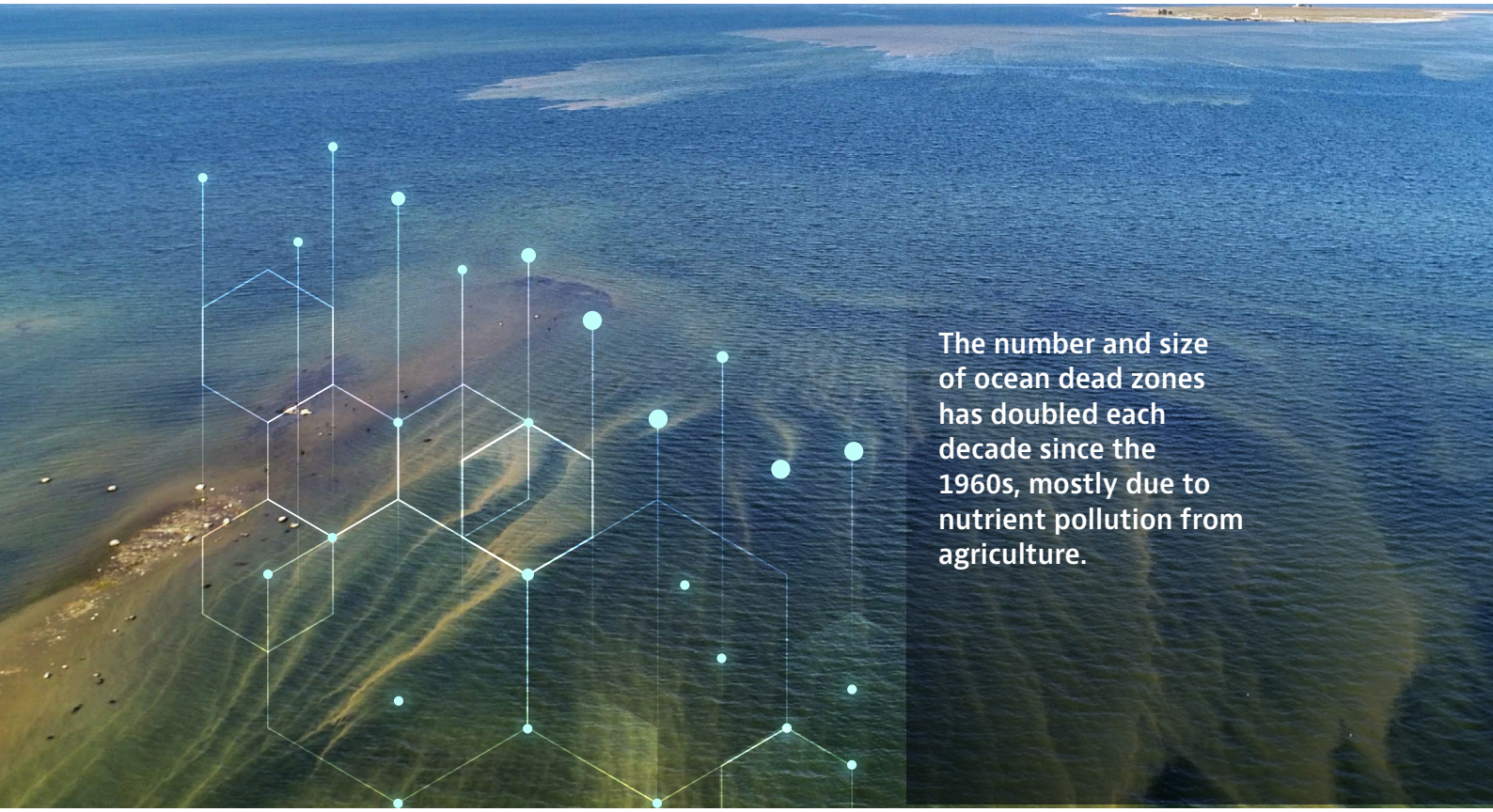
Figure 7. **Anthropogenic nutrients exacerbate or cause low oxygen-levels and dead zones**



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.

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 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.



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

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CONTACTS

Resource productivity and waste
Peter Börkey – *Peter.Borkey@oecd.org*

Water quality
Xavier LeFlaive - *Xavier.LeFlaive@oecd.org*

Maritime transport
Olaf Merk – *Olaf.Merk@itf-oecd.org*

Chemical safety
Eeva Leinala – *Eeva.Leinala@oecd.org*

The ocean and climate change

The ocean regulates the global climate by mediating temperature and influencing rainfall. The ocean has warmed unabated over the past decades, resulting in ocean acidification and sea level rise, as well as irreversible losses within marine ecosystems. Climate change is projected to result in the loss or degradation of much of the world's coral reefs and low-lying coastal wetlands (IPCC, 2022). 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

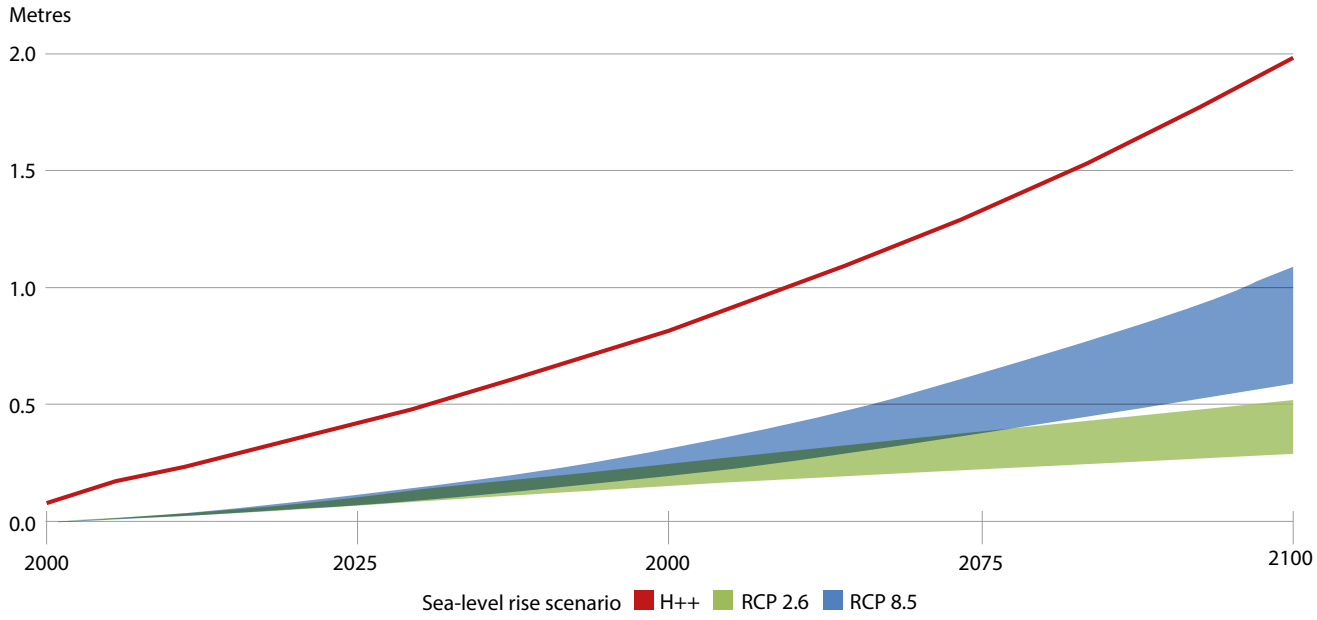
Coastal communities are at the front lines of climate change

Coastal zones provide a wide range of environmental, social and economic benefits. While they cover only 20% of the Earth's surface, they are home to 40% of the global population and host 75% of the world's largest cities. They represent key economic hubs and include some of the ecologically richest ecosystems, playing a key role in the regulation of ecological functions. Human activity and asset concentration in coastal areas are only set to grow in the coming decades, making coastal areas ever more critical in the global economy. Yet, coastal communities are disproportionately impacted by the increasing effects of climate change. The OECD's work on "Adapting to a changing climate in the management of coastal zones" (OECD, 2021) emphasises the growing importance of coastal areas in the global economy and analyses the increasingly complex challenges faced by coastal communities related to climate change. Sea-level rise, coastal storms and ocean warming and acidification exacerbate existing vulnerabilities and increase risks for coastal communities.

To address these challenges, it is crucial to scale up climate adaptation. The report "*Responding to Rising Seas: OECD Country Approaches to Tackling Coastal Risks*" (OECD, 2019) estimates the benefits and policy costs associated with coastal adaptation and reviews how OECD countries approach coastal risks. The report finds that, without adaptation, sea-level rise-induced coastal flooding is projected to cause annual losses equivalent to 4% of global GDP annually by 2100[1]. Implementing the right measures could reduce these impacts by 2-3 orders of magnitude. Climate adaptation should thus be a key consideration in the planning and implementation of coastal policies.

[1] This figure refers to projected costs under a RCP8.5 scenario.

Figure 8. **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, D. and J. Hinkel (2018), "Economically robust protection against 21st century sea-level rise", Global Environmental Change, Vol. 51, pp. 67-73, http://dx.doi.org/10.1016/J.GLOENVCHA.2018.05.003

Failing to act today can make it increasingly expensive to adapt later. Building on findings from case studies in Canada, Germany, New Zealand and the United Kingdom, the 2019 OECD report also provides an overview of the policy tools that can be used to encourage effective and equitable responses to coastal risks.

Infrastructure is both necessary to build resilience, while at the same time being exposed to climate change

Infrastructure networks will be affected by the impacts of climate variability and climate extreme events. 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 projected impacts of climate change over their lifetimes. Existing infrastructure may need to be retrofitted, or managed differently, because of climate change. The policy paper "Building resilience: New strategies for strengthening infrastructure resilience and maintenance" (OECD, 2021) outlines a framework for optimising existing infrastructure assets and building new resilient infrastructure. It also includes strategies for ensuring quality and performance over an asset's lifecycle. In addition, the "Implementation Handbook for Quality Infrastructure Investment" (OECD, 2021) provides a forward-looking view on how quality infrastructure investment can be implemented to deliver on key policy priorities, notably catalysing the low-carbon transition, safeguarding biodiversity, building resilience, addressing regional disparities, and underpinning sustainable development.

Nature can be a major part in strengthening coastal climate resilience

Given the significant uncertainty related to the magnitude, intensity and occurrence of the impacts of climate change, a flexible, forward-looking approach to building climat resilience is needed. This includes integrating hard protective infrastructure (e.g. sea walls) with nature-based solutions (e.g. protection or restoration of coastal ecosystems). The report "Scaling up Nature-based Solutions to Tackle Water-related Climate Risks" (OECD, 2021) provides an assessment of and recommendations for building an enabling environment for nature-based solutions to address water-related climate risks, including coastal flooding. Nature-based solutions are also an opportunity foster synergies between adaptation and mitigation efforts, as highlighted in the paper "Strengthening adaptation-mitigation linkages for a low-carbon, climate-resilient future" (OECD, 2021).

Countries must increase climate ambition

Climate change is driving fundamental changes to the planet with adverse impacts on human livelihoods and well-being, putting development gains at risk. The scale and extent of future risks for a given location is, however, subject to uncertainties in predicting complex climate dynamics as well as the impact of individual and societal decisions that determine future greenhouse gas emissions and patterns of socio-economic development and inequality.

The report "Managing Climate Risks, Facing up to Losses and Damages" (OECD, 2021) approaches climate-related losses and damages from a risk management perspective. It explores how climate change will play out in different geographies, over time, focusing on three types of hazards: slow-onset changes such as sea-level rise; extreme events including heatwaves, extreme rainfall and drought; and the potential for large-scale non-linear changes within the climate system itself. The report explores approaches to reduce and manage risks with a focus on policy action, finance and the role of technology in supporting effective risk governance processes.

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.

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.

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CONTACTS

Catherine Gamper – *Catherine.Gamper@oecd.org*
Aimée Aguilar Jaber – *Aimee.Aguilarjaber@oecd.org*

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%.

The Sustainable Ocean for All Initiative

More than 3 billion people rely on the ocean for their livelihoods worldwide, the vast majority in developing countries. For many of these countries, ocean-based industries, such as tourism, maritime tourism and fisheries, are important drivers of economic development and a critical source of employment, income and foreign exchange.

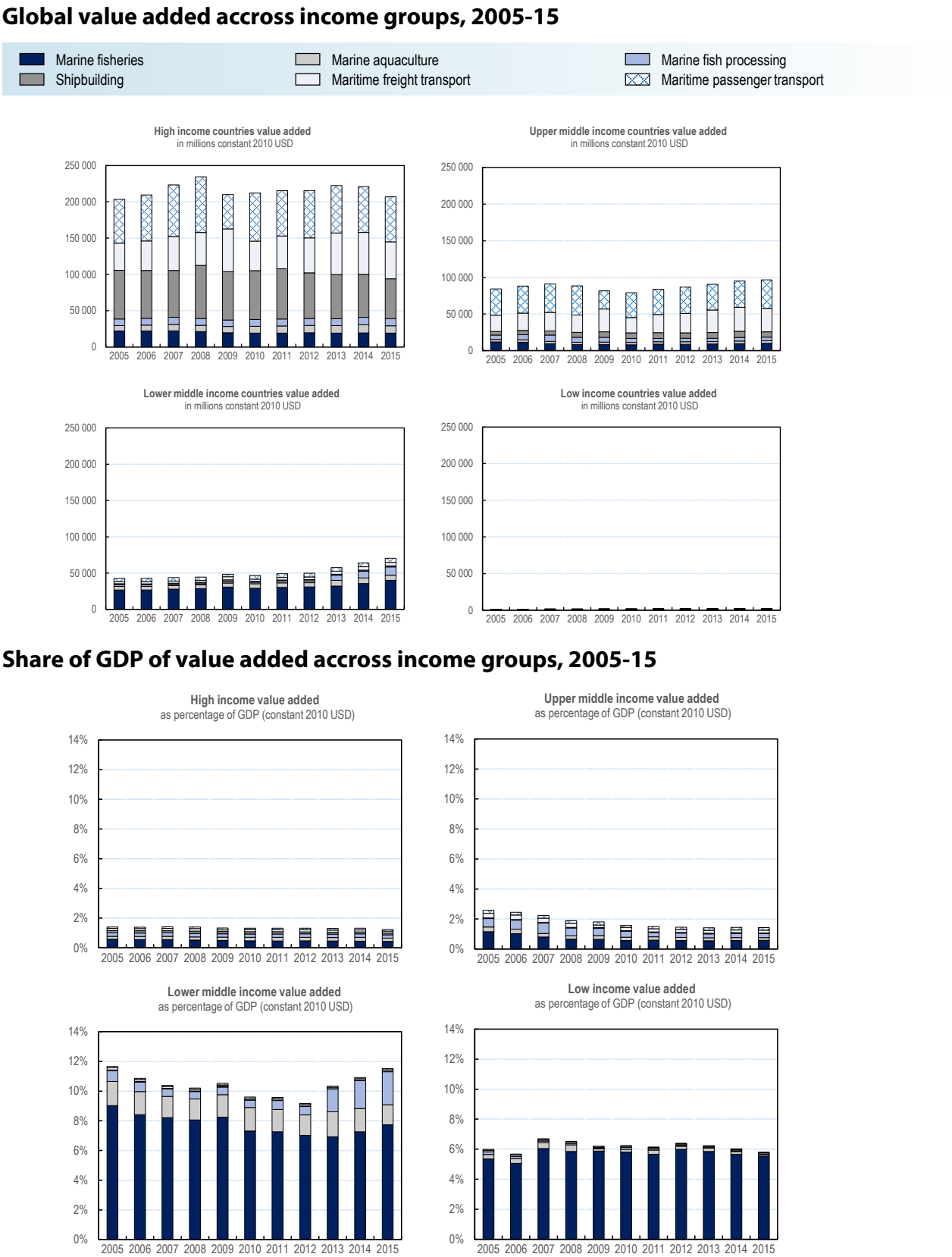
As the ocean becomes the center stage for a new range of economic activities, it is critical that developing countries be in a position to turn new and emerging ocean-based sectors into catalysts for long-term, nature-positive and inclusive sustainable development. A sustainable use of the ocean also holds the potential for fuelling a recovery that will put countries on track for a cleaner, greener, more equitable and resilient future. From offshore wind energy, to sustainable aquaculture, to marine biotechnologies, the ocean offers new opportunities to diversify economies sustainably and enhance resilience. It can provide clean, renewable energy, enhance society's resilience to climate and coastal shocks, and provide food and livelihoods to billions.

Developing countries are, however, currently in a paradoxical situation: they are on average the most reliant countries on ocean economy sectors in terms of the share of their GDP that depends on ocean-based sectors. Yet, they only capture a small fraction of the global value added from the ocean economy (Figure 9)[2]. For instance, Small Island Developing States (SIDS) and coastal Least Developed Countries (LDCs) account for 0% of off-shore wind farming, the fastest growing sector of the ocean economy, and for 0.09% of aquaculture, the world's fastest growing food production. Challenges in accessing the science, policy evidence and financing have considerably constrained developing countries' ability to harness new opportunities from a sustainable ocean economy.

International development co-operation has a key role to play in ensuring that the expansion of the global ocean economy is guided by institutional arrangements, policies and financial flows that are aligned with the imperative of sustainability and with the needs of developing countries and the world's poorest and most vulnerable people. Development co-operation also has a significant role to play to facilitate developing countries' access to the policy evidence, innovations, and financial resources needed to seize new, sustainable, investment opportunities from the ocean economy and drive a sustainable recovery.

[2] OECD (2020) Sustainable Ocean for All: Harnessing the Benefits of Sustainable Ocean Economies for Developing Countries.

Figure 9. **The paradox for developing countries: relying the most on ocean economy sectors but capturing a negligible share of global value added from the ocean economy**



Source: OECD (2020) Sustainable Ocean for All: Harnessing the Benefits of Sustainable Ocean Economies for Developing Countries

Quantifying official development assistance for sustainable ocean economies

Evidence on global finance for the ocean from its various sources – private, public, domestic and international – remains 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 this can be considered sustainable. To contribute to fill this gap, as part of the Sustainable Ocean for All initiative, the OECD has begun to track global development finance for the ocean, detailing its scope, sources and destinations and providing estimates of the share that is sustainable. A dedicated methodology was developed for this purpose, contributing to lay the foundations of a common understanding of what defines ODA interventions in support of sustainable ocean economies.

Ocean-relevant ODA estimates are organised around three key indicators:

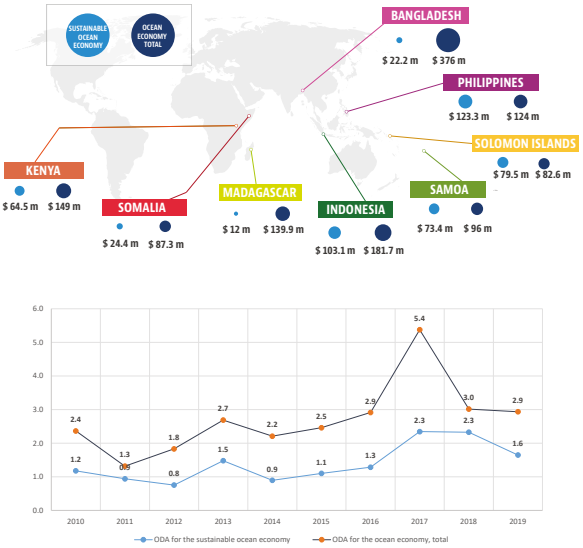
- **ODA for the ocean economy**: ODA in support of ocean-based industries and marine ecosystems, irrespective of whether the support explicitly takes sustainability considerations into account. For instance, fisheries projects or port infrastructure projects with no specific focus on sustainable development would be included.

- **ODA for the sustainable ocean economy**: This is a subset of ODA for the ocean economy. It identifies ocean conservation activities as well as support for enhancing the sustainably and climate-resilience of ocean-based industries. For instance, projects in support of mangroves restoration would be captured, as would sustainable coastal tourism, and sustainable fisheries projects.

- **ODA for reducing ocean pollution from land**: ODA for land-based activities that reduce negative impacts and/or have a positive impact on ocean, such as wastewater treatment and waste management projects. This indicator is included in recognition of the strong interrelation between land-based and marine activities and the fact that most ocean pollution originates from land-based activities.

In 2019, ODA for the ocean economy totaled USD 2.9 billion. The share of this funding that contributed to enhancing the sustainability of ocean-based sectors and ocean conservation (i.e. ODA for the sustainable ocean economy) was USD 1.6 billion in 2019, representing 0.8% of total ODA in the same year. (Figure 10).

Figure 10. **Trends of ODA for the ocean economy**



Source: Sustainable Ocean for All database, based on OECD-DAC Creditor Reporting System. All data available for free on: https://oecd-main.shinyapps.io/ocean

Global and country-level policy support and the Blue Recovery Hubs

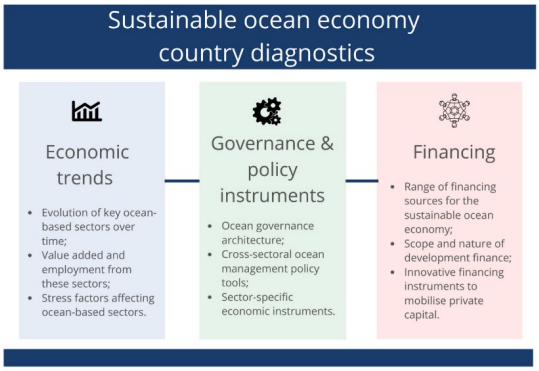
In 2020, the Sustainable Ocean for All Initiative produced a comprehensive report quantifying the economic trends of the ocean economy across developing countries and identifying existing and innovative policy and financing tools to enhance its sustainability.

Since then, the Initiative has continued to provide global level analysis, for instance assessing the impact of the COVID-19 crisis on the ocean economies of small island developing states, as stated in *COVID-19: Towards a Blue Recovery in Small Island Developing States*.

Recognising the need for coherent cross-sectoral policy approaches for sustainable ocean economies, the Sustainable Ocean for All has also started a series of 'Sustainable Ocean Economy Country Diagnostics'.

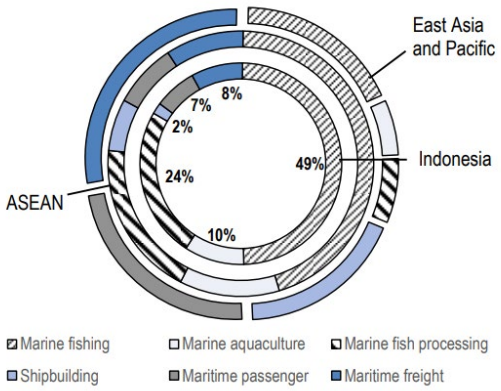
These studies offer a holistic and cross-sectoral analysis of the ocean economy of individual countries and the climate and environmental impacts affecting them. They also provide evidence on policy and financing mechanisms that can be used to enhance the sustainability of ocean economy sectors and contribute to ocean health. (Figure 11). So far, the OECD published the sustainable ocean economy country diagnostics of Indonesia (Figure 12) and the one of Cabo Verde is forthcoming).

Figure 11. **OECD Sustainable Ocean Economy Country Diagnostics - analytical framework**



Source: Sustainable Ocean for All Initiative.

Figure 12. **The Sustainable Ocean Economy Country Diagnostics of Indonesia**



Source: OECD (2021) Sustainable Ocean Economy Country Diagnostics of Indonesia based OECD-STI Experimental Ocean-Based Industries Database

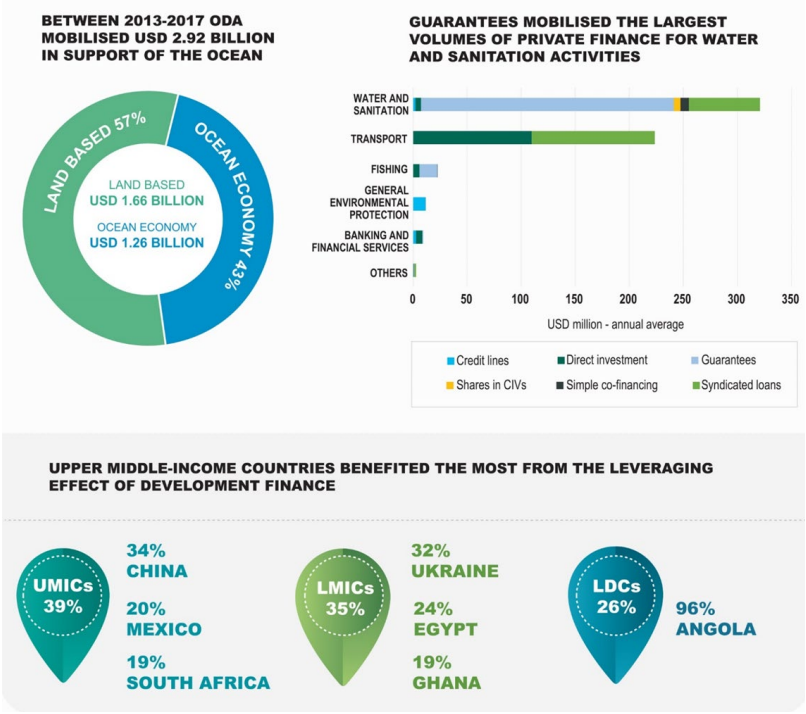
In 2021 the Sustainable Ocean for All Initiative launched the 'Blue Recovery Hubs' – policy support to assist countries in not just restarting their ocean economy sectors but transform them for greater sustainability and seize new, sustainable economic opportunities that can help diversify the economy, build resilience and fuel a sustainable, blue, recovery. The first Blue Recovery Hub has been established in Fiji in collaboration with the World Economic Forum and Friends of Ocean Action, and more Blue Recovery Hubs are being established in 2022.

Finance for sustainable ocean economies

Development co-operation can fund sustainable investments directly but also help align more private and public finance for the ocean economy to sustainability. This can be done in different ways: through blended finance arrangements, through support to innovative financing mechanisms, and by ensuring that sustainability is integrated in traditional financial services and investments, in financial markets (e.g. stocks and bonds), and in credit markets (e.g. loans or bonds).

The Sustainable Ocean for All Initiative tracks private finance mobilised by ODA for the ocean economy. Our estimates suggest that a total of USD 2.96 billion of private finance in support of ocean-related projects was mobilised by ODA in 2013-17, equivalent to an annual average of USD 593 million. Simple ODA grants, standard loans and other leveraging financial instruments - such as guarantees, syndicated loans, etc. - were used to de-risk investments or structure returns so as to improve the commercial investments viability and make projects more attractive through a range of blended finance arrangements. (Figure 13).

Figure 13. **Private finance mobilised for the ocean economy by Official Development Assistance**



Source: OECD (2020) Sustainable Ocean for All: Harnessing the Benefits of Sustainable Ocean Economies for Developing Countries.

However, these flows may literally be a drop in the ocean without greater efforts to curb and re-orient the financial flows currently fuelling destructive practices that often have the largest impacts on developing countries' fish populations, coasts and tourism, food security, and livelihoods. This is why the Sustainable Ocean for All Initiative has been working closely with UNEP-FI through an international task force for the implementation of the Sustainable Blue Economy Finance Principles, for the development of three guiding documents: *The Rising Tide*, *Turning the Tide*, and *Diving Deep*[3]. More remains to be done to establish and implement the policies, regulations and financial levers needed to mainstream sustainability in traditional financial services and investments, in financial markets (e.g. stocks and bonds), and in credit markets (e.g. loans or bonds).

Impactful Development Co-operation for Sustainable Ocean Economies

Despite growing momentum on ocean matters and long-standing co-operation efforts of OECD members in specific areas of the ocean economy (i.e. fisheries, marine conservation, etc), common definitions, principles and guidance for ensuring that the international development community is effectively contributing to sustainable ocean economies is still lacking.

To fill this gap, the OECD has started to work on guidance for impactful development co-operation in support of sustainable ocean economies. This work is articulated as a series of workshops and discussions on specific areas of the ocean economy with a view to share good practices, foster mutual learning and identify effective and scalable approaches. In 2022, this work will focus on the following areas, for which it will produce dedicated evidence: tackling plastic pollution; promoting sustainable blue foods; and integrating gender equality in development cooperation in support of sustainable ocean economies.

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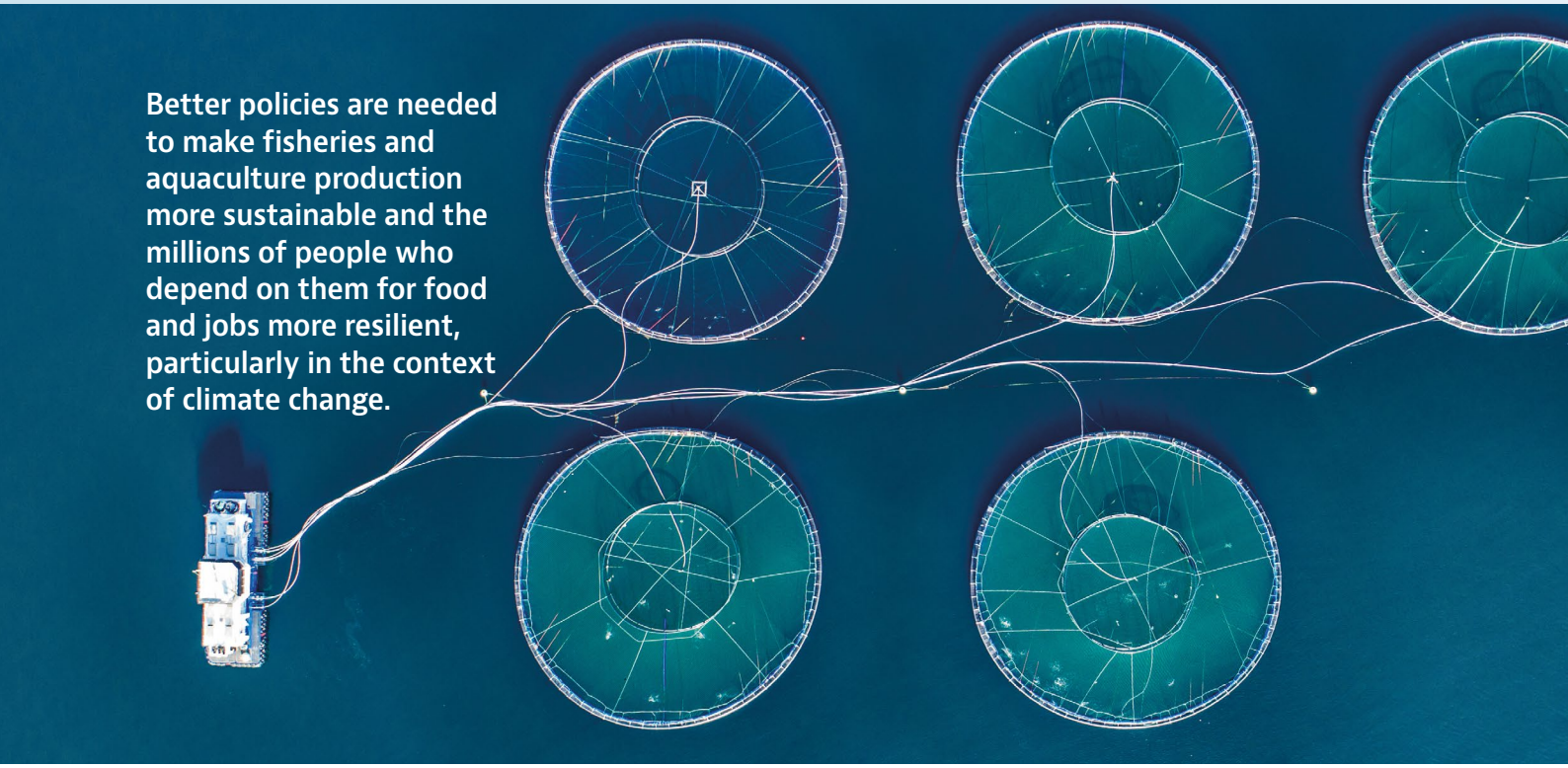
CONTACT

Piera Tortora – *Piera.tortora@oecd.org*



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.

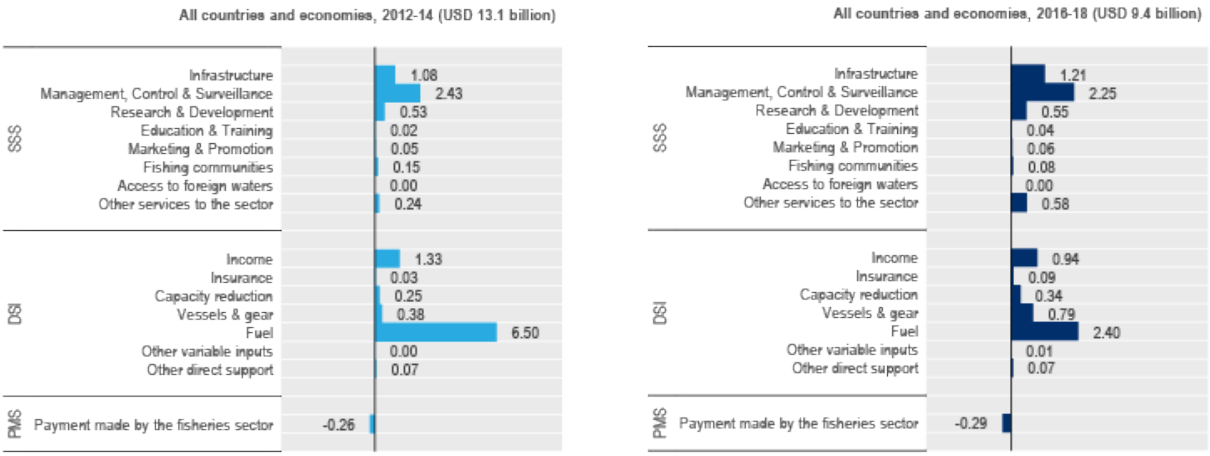
Sustainable and resilient fisheries and aquaculture

Fisheries are fundamental to feeding the global population, and creating jobs and resilience in coastal communities. However, to achieve these socio-economic goals while preserving biodiversity and the provision of the ecosystem services on which the "blue economy" relies, fish stocks must be managed sustainably. 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. Over the last two decades, total seafood output value in the OECD 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.

However, climate change, overfishing and pollution are placing global fisheries under increasing pressure. Indeed, of the 1,119 stocks reported on in the OECD Review of Fisheries 2020, 254 (23%) were in an unacceptable status with regards to biological sustainability, calling for remedial action. Global fisheries could generate billions more in benefits if they were better managed. Governments are increasingly aware of the shortcomings of fisheries and aquaculture management frameworks, and that smarter regulations and new technologies are needed to improve sustainability and productivity. 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. Through the biannual Review of Fisheries, the OECD helps governments establish good policies and governance. This can help 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.

The OECD also produced more focused reports targeting fisheries policy reform. For example, Encouraging policy change for sustainable and resilient fisheries examines how to enable policy reforms in difficult contexts and find a successful pathway to reform through improved governance, stakeholder consultation, and mobilisation of scientific evidence and analysis.

Figure 14. **Changes in government support to fisheries (FSE) disaggregated in its subcomponents**



Note: SSS =Support for Services to the Sector; DSI = Direct support to individuals and companies in the fisheries sector; PMS = Payments made by the fisheries sector trend.
Source: The OECD Review of Fisheries 2020

Government support for resilient and sustainable fisheries

Through the fisheries support estimate (FSE) database, the OECD measures and describes fisheries support policies in a consistent and transparent way across member countries and important non-member fishing economies. This database is a unique resource and is helping to inform negotiations on fisheries subsidies taking place at the World Trade Organization, monitor progress towards achieving the United Nations Sustainable Development Goal 14 and inform domestic policy discussions. 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 on the goals they were designed to meet.

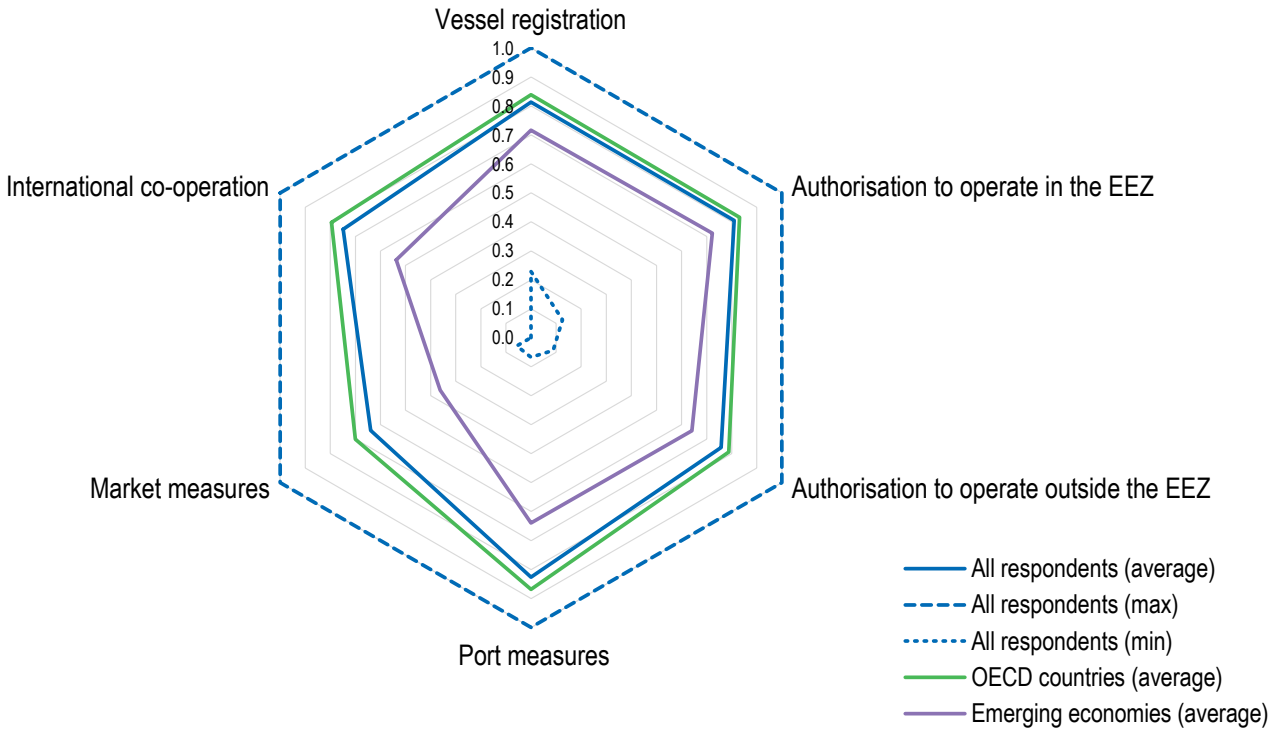
Analytical work based on the FSE (Martini and Innes, 2018) suggests ways to better align the choice of support policies with stated objectives for the sector while minimising their impact on resources. To reduce negative impacts on the biological sustainability of fish resources and inequitable effects across fleet segments, governments should move away from policies that support inputs and towards those that help fishers operate their businesses more effectively and increase their profitability. The OECD Review of Fisheries 2020 suggests scope for reform is significant: from 2016-18, USD 3.2 billion was annually spent on policies that reduce the cost of inputs in the 39 countries and economies reporting to the FSE database. Support to fuel, alone, was the single largest direct support policy, accounting for 25% of total support to the sector. Conversely, less than a third of that amount (USD 1.0 billion) was granted in support that is partially de-coupled from fishing activities – such as income support and special insurance systems (Figure 14).

Implement strong frameworks to tackle illegal fishing

The recent report "*Eliminating government support to illegal, unreported and unregulated fishing*" (IUU) provides practical guidance for governments on how they can prevent their support policies from benefiting IUU fishing. These steps include: making support conditional on having a unique vessel identification and sharing detailed information on the beneficial owner; adopting a comprehensive yet practical definition of IUU fishing in national legislation; ensuing the process for withdrawing support is timely and sanctions are in proportion to the offense committed; and fully implementing existing mechanisms to exclude IUU fishing from markets, such as the Port State Measures Agreement.

Two additional OECD studies, "*Closing gaps in national regulations against IUU fishing*" and "*Intensifying the fight against IUU fishing at the regional level*", help countries identify how to tackle IUU fishing. The reports investigate the extent to which governments meet have implemented laws and regulations to fight IUU fishing, and whether Regional Fisheries Management Organisations (RFMOs) use best practices to support their member countries fight IUU fishing. Results of these papers and a follow-up study in the Review of Fisheries 2020 show there has been considerable progress in improving regulatory frameworks and enforcing legislation over the last decade, but gaps remain (Figure 15). 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 fishing, while tougher sanctions should be applied to 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. RFMOSs 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.

Figure 15. **Uptake of best policies and practices against IUU fishing, 2018**



Note: Indicator scores range between 0 and 1, with increasing scores indicating higher levels of adoption and implementation of the measures covered by each indicator. A total of 33 countries and economies participated, including 26 OECD countries, as well as Argentina, the People's Republic of China, Costa Rica, Indonesia, Chinese Taipei, Thailand and Viet Nam – together referred to as "emerging economies.
Source: The OECD Review of Fisheries 2020

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CONTACT

Claire Delpeuch – *Claire.Delpeuch@oecd.org*

Maritime transport 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. In order to assist countries in that discussion, the International Transport Forum has established in 2021 a Common Interest Group on Decarbonising Shipping. Main theme of that group is carbon pricing and fuel standards in shipping.

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. Ship completions have rebounded sharply after the supply and demand shock linked to the COVID-19 pandemic which was particularly severe in the first half of 2020. Demand for container ships has been notably very strong from mid-2020 driven by the increase of international trade. Russia's aggression against Ukraine has also impacted the shipping and shipbuilding markets notably as it impacts the trade of several commodities such as gas, oil and grain. For instance, as a consequence of this war, the demand for Liquefied natural gas (LNG) carriers is likely to increase because of the uncertainty related to gas supply from Russia via pipeline.

Moreover, 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 2022 specifically addresses the key challenges of the global shipbuilding industry including market distortions, excess supply and excess capacity.

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CONTACT

Olaf Merk – *Olaf.Merk@itf-oecd.org*
Laurent Daniel – *Laurentc.Daniel@oecd.org*

Ocean 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 science and innovation 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 science 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 (OECD, 2021a and 2021b).

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, 2021b).

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, digital twins, 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 (OECD, 2021a). 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 science and innovation will contribute to sustainable ocean activities

With the ongoing 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.

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.

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CONTACT

Claire Jolly – *Claire.Jolly@oecd.org*

Financing and investment for a sustainable ocean

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 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 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 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.

KEY PUBLICATIONS

OECD (2020), "Reframing Financing and Investment for a Sustainable Ocean Economy", *OECD Environment Policy Papers*, No. 22, OECD Publishing, Paris, https://doi.org/10.1787/c59ce972-en.

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

CONTACT

Andrew Prag – *Andrew.Prag@oecd.org*

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www.oecd.org/ocean

ocean@oecd.org

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