Executive Summary

Global Ocean Science Report

Investing in Sustainable Ocean Solutions

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Intergovernmental Oceanographic Commission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Published in 2026 by the United Nations Educational,
Scientific and Cultural Organization,
7, place de Fontenoy, 75352 Paris 07 SP, France

https://doi.org/10.71245/MSEK9116

For bibliographic purposes, this document should be cited as follows:

IOC-UNESCO. (2026). *Global Ocean Science Report – Investing in Sustainable Ocean Solutions, Executive Summary*. K. Evans, K. Isensee, S. Park and C. Rosin (eds.), Paris: UNESCO (IOC Policy Series, 2026-2). doi: 10.71245/MSEK9116

Cover design: Hugo Salais/Metazoa Studio

Graphic design: UNESCO

(IOC//POL/2026/2)

Global Ocean Science Report

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Executive Summary

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Intergovernmental Oceanographic Commission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Global Ocean Science Report Third Edition

Intergovernmental Oceanographic Commissions (IOC) of UNESCO

The next five years are decisive. They will determine whether ocean science can accelerate fast enough to achieve the ambitions of the Ocean Decade, support the Sustainable Development Goals and deliver measurable progress in ocean science capacity, investment and collaboration. The third edition of the Global Ocean Science Report highlights the progress already being made and the actions needed to accelerate that progress over the next five years.

Key Priorities Include:

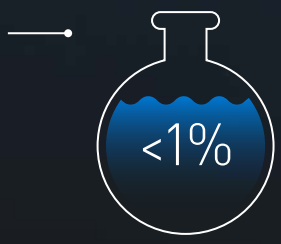
- **Increased and better coordinated funding**
- **Strengthened workforce development**

The report's main findings include:

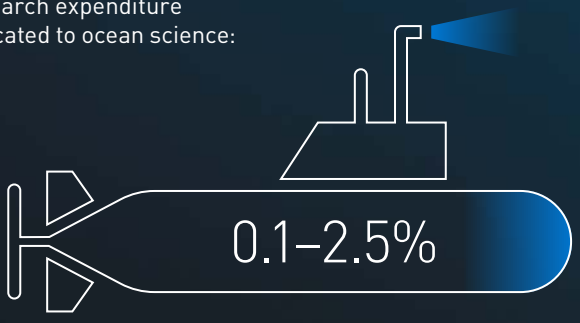
Investment remains below ambition

Despite the ocean's critical role in supporting economies, climate resilience and human wellbeing, investment in ocean science remains low.

Annual median share of national research budgets allocated to ocean science:



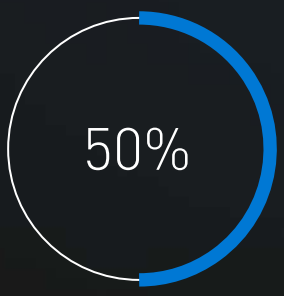
Typical range of national research expenditure allocated to ocean science:



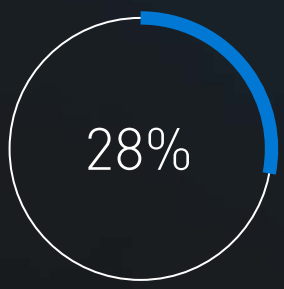
Ocean Decade ambitions require greater support

The UN Decade of Ocean Science has mobilised hundreds of actions worldwide, but financing remains a major constraint to achieving its ambitions and outcomes.

50% have secured less than half the funding required to achieve their objectives.



28% of endorsed Ocean Decade actions are fully funded.



Despite funding and infrastructure challenges, ocean science continues to expand.

Ocean science publications have doubled over the last 15 years

x2

90% of developing-country publications involve international partnerships

90%

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- **Sustained collaboration and knowledge sharing**
- **Improved observation systems and infrastructure**

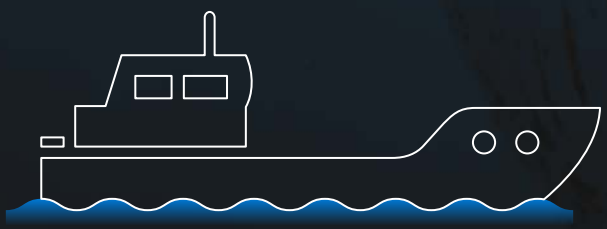
Strengthening how investment is tracked

Many countries struggle to track ocean science expenditure. Funding is often distributed across ministries, agencies and programmes, making it difficult to assess investment needs and align funding with national priorities.

More than 50% of countries report funding sources are decentralised and scattered

Expanding access to ocean science

Ocean science depends on people, vessels, observing systems, laboratories, satellites and emerging technologies. Access to these resources remains concentrated in a small number of countries.



66% of research vessels are operated by just 10 countries

55% of research vessels are <24m

Publications are increasing, partnerships are strengthening and new investment models are emerging.

82% of countries participate in capacity-building partnerships

82%

Philanthropic funding for ocean science has grown from US$0.5 billion to US$1.2 billion

Ocean science – investing in sustainable ocean solutions

Marta Masdeu Navarro/Shutterstock.com

The current decade will be decisive for ocean science. As climate change accelerates, biodiversity declines, global populations grow and the ocean economy expands, the demand for reliable ocean knowledge has never been greater. At the same time, there has been an increase in misinformation and a proliferation of pseudo-scientific perspectives that are only tenuously based on facts.

The ocean is vital to global economies, the environments that sustain the global population and the livelihoods and culture of coastal communities. The ocean regulates the climate across global, regional and local scales, and in doing so, influences all of society and the ecosystems they rely on. The ocean enables global trade and supports rapidly growing industries from offshore energy to marine biotechnology. Over the last few decades, the ocean economy has contributed an estimated 3–4% of global economic value. If considered a country, the ocean economy would be the world's fifth-largest economy.

Ocean science benefits multiple stakeholders – directly and indirectly – including businesses, industries, communities and the activities that contribute to their livelihoods and well-being. It is vital to understand current impacts and near- and medium-term trajectories of climate change for coastal planning, infrastructure development, fishing and aquaculture operations (particularly in building resilience in businesses and the wild stocks they rely on), early warning systems that enhance community safety, and shipping and defence industries which ensure safety at sea and maritime security.

Charting ocean science capacity

The Global Ocean Science Report (GOSR) tracks the status and trends of global ocean science capacity, investment, outputs and the global connections that facilitate both the generation and use of ocean science knowledge and information.

This third edition of the GOSR builds on the findings presented in the first and second editions of the report. It extends time series on investment and scientific capacities and activities, enabling a broader analysis of trends, resilience and vulnerability. This edition of the GOSR provides the most comprehensive assessment of ocean science to date, covering how knowledge is generated, shared, applied and translated into societal benefits.

Application of the GOSR

The GOSR is a resource for national and international ocean science managers and funding organizations to identify strengths, opportunities, gaps and vulnerabilities in ocean science capacity, investment and outputs, as well as new and established partnerships.

Data spanning almost 15 years provides the basis for much of the information provided in this report, allowing the identification of impacts of disruptive events and raising the importance of ocean science globally.

Through its goal to provide an up-to-date view of the state of ocean science, the GOSR encourages countries to consider their ability to assess their ocean science capacities and improve their associated information collection, collation and reporting systems. In particular, the GOSR provides a framework through which countries can assess and monitor their national ocean science expenditure, and what is required to develop and maintain ocean science workforces and infrastructure to support ocean economies, maintain ocean health and sustain human well-being. The report assists in expanding the coverage and application of ocean observations by identifying areas with limited technical capacity.

The information provided by the GOSR can be utilized to guide national and international roadmaps that promote equity across communities and countries through addressing training needs, infrastructure development and education programmes.

GOSR data collection and analysis

As in previous editions of the report, the third edition of the GOSR draws on a number of resources, combined to provide contemporary information on ocean science themes, extend the time series from previous editions and incorporate new information. These include:

I. a questionnaire distributed to IOC Member States;

II. a bibliometric analysis based on international literature databases;

III. a review of peer-reviewed literature, national reports and web-based sources; and

IV. gender-specific analyses of international conference/ symposium attendees.

Quantitative information derived from the questionnaire and bibliometric analysis, such as the number of peer-reviewed publications, research vessels and the extent of national funding, was combined with qualitative information, such as articulation of national ocean science priorities in policies or strategies, and independent resources and indicators, to provide an overview of the current status of ocean science and trends over the last 15 years.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From data to evidence

©Ocean Image Bank - Dimitris Poursanidis

National expenditure on ocean science: a growing mismatch

Global commitments focused on advancing sustainable development highlight the important role of ocean science and requirements for use through capacity development and knowledge exchange. Despite progress in expanding ocean science capacity and knowledge, ocean science overall remains underfunded, fragmented and disproportionately centred in the developed world.

Investment in ocean science remains conspicuously low.

A total of 40 countries provided ocean science expenditure data for one or multiple years between 2013 and 2024, pertaining to the Sustainable Development Goal (SDG) indicator 14.a.1. Together, these provide more than 150 data points on the proportion of total research budget allocated to marine technology research. The annual **median share of national research budgets allocated to ocean science remains below 1%** (**Figure ES1**). This is in stark contrast to the 3–4% the ocean provides to global economies. Although national research budgets vary substantially across countries and years and are reported as high as 8%, most estimates range from 0.1% to 2.5 % (**Figure ES2**). Countries with higher expenditure tend to be countries with economies that have greater associations with the ocean.

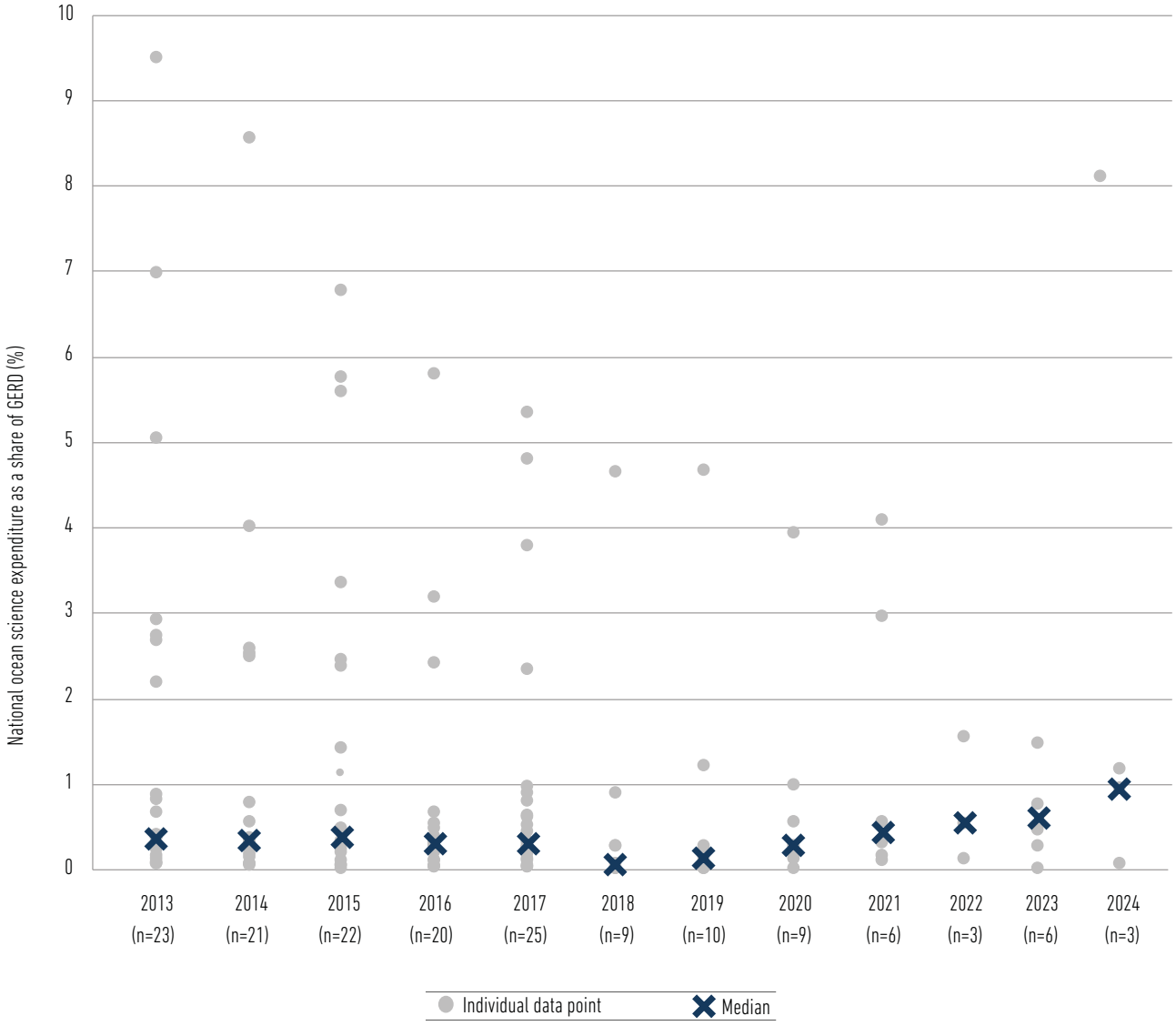


Figure ES1. The distribution of ocean science expenditure as a share of gross domestic expenditure on research and experimental development (GERD, %) reported by countries across 2013–2024 with the number of countries reporting expenditure identified below each year. *Sources*: The GOSR questionnaire and UNESCO Institute of Statistics.

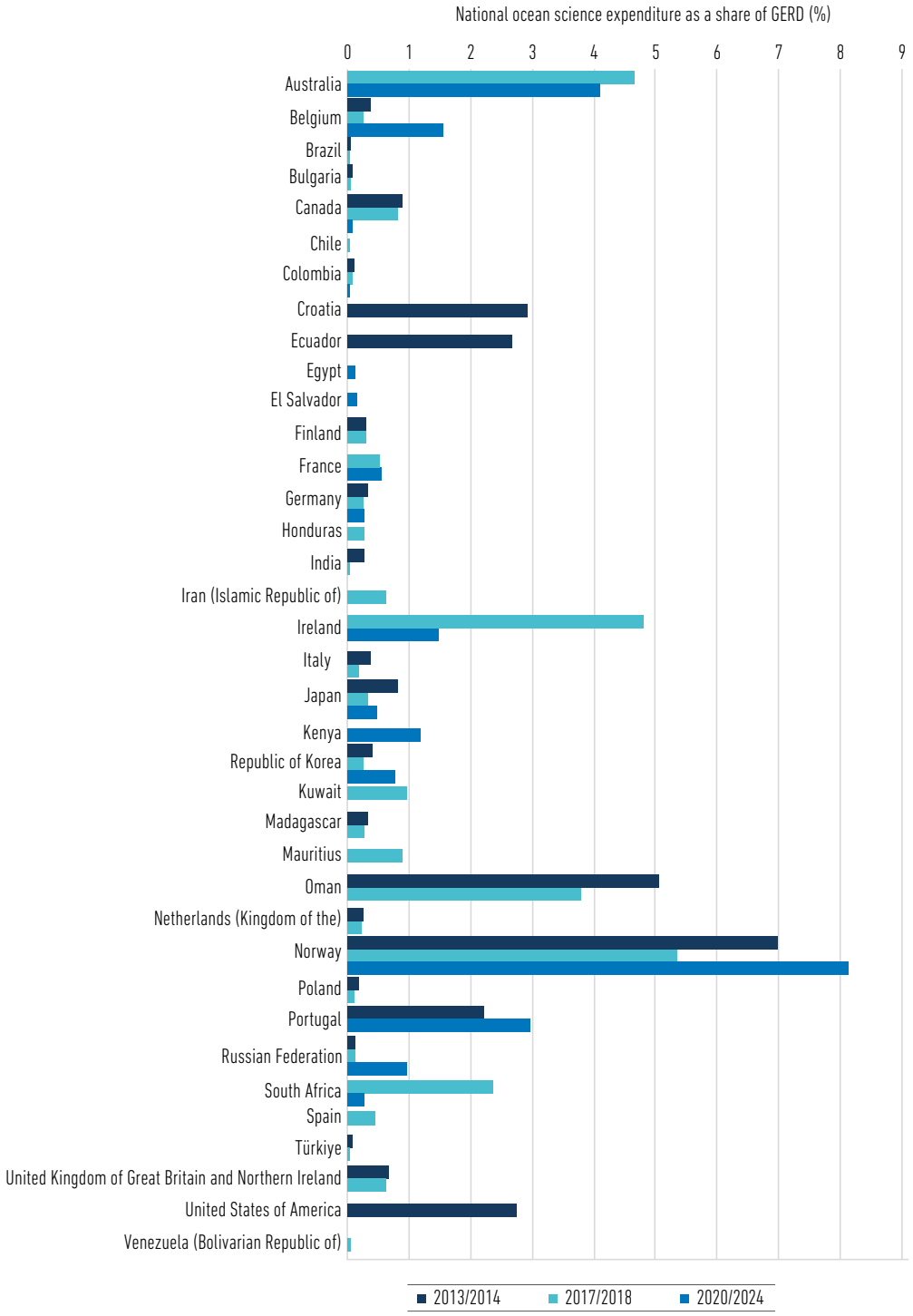


Figure ES2. National ocean science expenditure as a share of GERD (%) of countries for the first, second or third edition of the GOSR.
Sources: GOSR questionnaire and GERD data - UNESCO Institute of Statistics.

The Ocean Decade funding gap

The UN Decade of Ocean Science for Sustainable Development (Ocean Decade) has mobilized hundreds of actions worldwide across a range of ocean science disciplines addressing multiple ocean challenges.

However, funding remains a critical constraint for those actions to progress the objectives of the Ocean Decade and to attain its seven outcomes (Figure ES3):

- Only 28% of all endorsed actions are fully funded; and
- 50% have secured less than half of the funding they need to achieve their objectives.

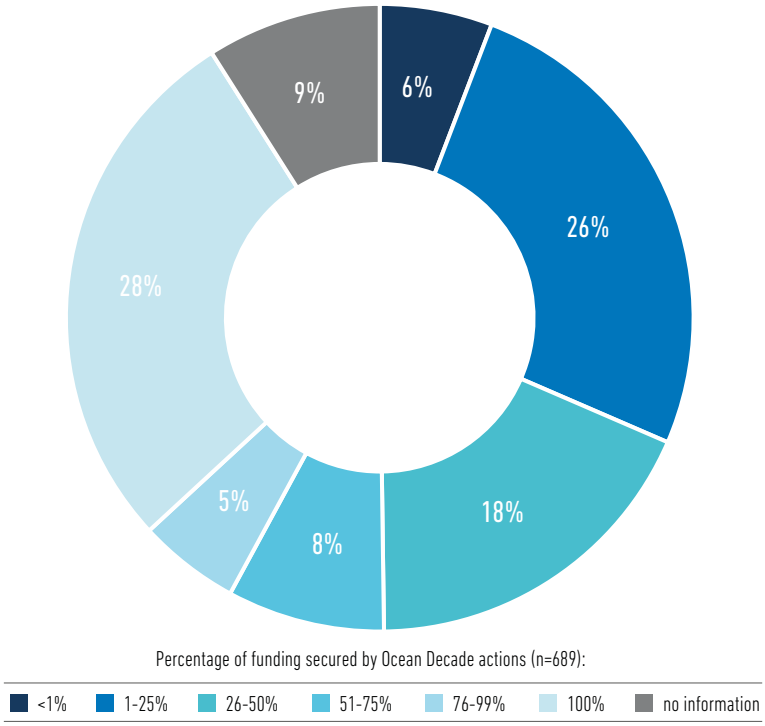


Figure ES3. Percentage of funding attained by Ocean Decade actions to fully implement their activities as of August 2025. *Source*: Ocean Decade Coordination Unit.

Emerging funding sources

The private sector has transitioned from a passive user of ocean data to a proactive co-producer and funder of ocean science. This shift has been driven by the rapid growth of the blue economy, emerging digital ocean technologies and the increasing corporate demand for climate-related risk assessments. Philanthropic foundations can often connect science, policy, financial frameworks and mechanisms, and communities more effectively than academic institutions, and can also foster collective action. Since foundations sit outside of government and political cycles, they can often commit to a longer-term vision, as they are not limited by discipline- or sector-based specializations and can therefore foster cross-sector collaboration. Flexible financing mechanisms can support early-stage proof of concept and rigorous testing, allowing for fail-fasts and adaptive learning in high-risk research.

- Philanthropy is increasingly important but remains only a fraction of national investment, growing from **US$ 0.5 billion in 2010–2014** to about **US$ 1.2 billion in 2023–2024**, which is equal to 22% of the annual ocean science budget reported by Japan in 2023 and 60% of the annual ocean science expenditure by Germany in 2022.

Challenges in assessing ocean science expenditures

Tracking ocean science investment at the national level is difficult for several reasons:

- Almost 60% of the countries that provided information to the GOSR stated that funding sources are decentralized, scattered across ministries, agencies and programmes, making compilation of information on budgets and expenditure challenging.
- More than 50% of countries highlighted that ocean science expenditure overlaps with broader climate or environmental expenditure, making it hard to isolate ocean-specific investments.
- Many countries lack dedicated mechanisms for monitoring ocean science investment.

The lack of systems necessary for identifying, compiling and assessing information on ocean science expenditure limits understanding of the national investment and capacity available to support ocean economies. This in turn limits the development and implementation of national strategies that can identify and address research, capacity and technology needs to grow and sustain ocean economies.

People: the foundation of ocean science

The generation and use of ocean science depends on a multitude of human actors across academic, operational, local and Indigenous knowledge systems: these include researchers, technicians, data and knowledge specialists, educators, field teams, and specialized and non-specialized support personnel. Together, these actors form a critical component of global ocean science capacity. Collectively, these actors generate data and information, create new knowledge, drive methodological and technological innovations, and ensure the functioning and maintenance of specialized equipment and infrastructure. Educators, communicators and community partners contextualize findings and strengthen society's ability to understand and respond to ocean challenges. The capacity of the workforce within countries contributing to the GOSR is, however, unevenly distributed. Of the 24 countries that submitted information, 5 countries (China, France, Germany, Russian Federation and Portugal) each have an ocean science workforce that is as large as the 19 remaining countries combined. This suggests that a small number of countries contain a large share of the global ocean science workforce (**Figure ES4**).

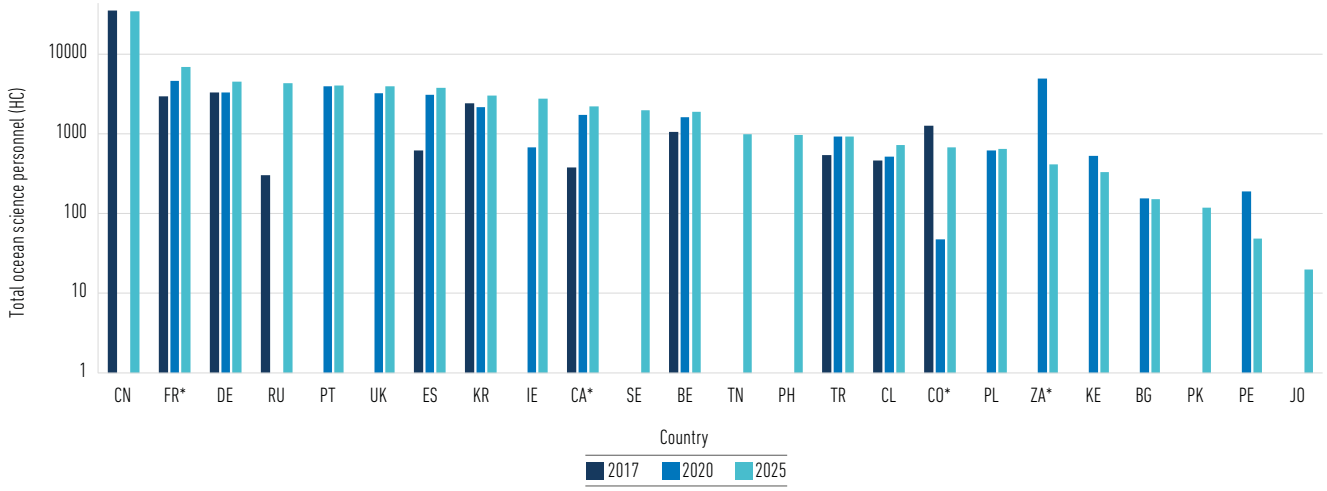


Figure ES4. Total number of ocean science personnel reported by countries responding to the 2025 GOSR questionnaire (n=24, blue), with data from previous GOSR questionnaires provided when available. Values are displayed on a logarithmic scale to improve readability and allow comparison among countries. China (CN); France (FR); Germany (DE); Russian Federation (RU); Portugal (PT); United Kingdom of Great Britain and Northern Ireland (UK); Spain (ES); Republic of Korea (KR); Republic of Ireland (IE); Canada (CA); Sweden (SE); Belgium (BE); Tunisia (TN); Philippines (PH); Türkiye (TR); Chile (CL); Colombia (CO); Poland (PL); South Africa (ZA); Kenya (KE); Bulgaria (BG); Pakistan (PK); Peru (PE); Jordan (JO). Note: * denotes countries using full-time equivalent (FTE) values in 2025 reporting instead of headcount (HC). Source: GOSR questionnaires.

Workforce composition

- Researchers make up roughly **50% of personnel** working in ocean science, although this varies widely across countries (20–80%), reflecting contrasting institutional models.
- The largest age group engaged formally in ocean science is **35–54 years.**

Gender balance

- Countries contributing to the three editions of the GOSR report an average of around **40% of women in the ocean science workforce** (**Figure ES5**).
- For the years 2020–2024 , countries contributing to the GOSR reported 19–65% of the research community as women, with an average of **43%** (**Figure ES5** average values in 2017/2018 were 39% and for 2013/2014 38%). This figure compares to an average of **31.4% female researchers across all sciences in 2023.**

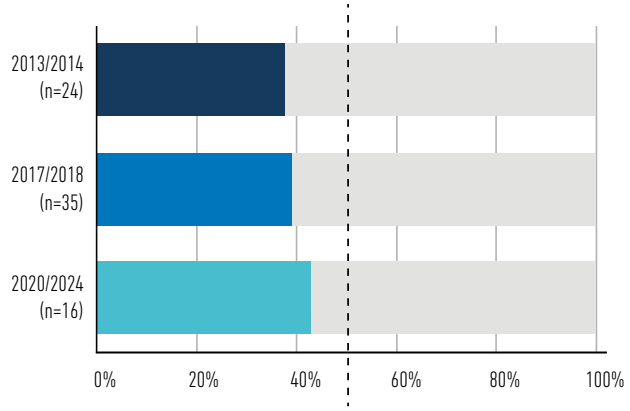


Figure ES5. Average percentage of women researchers in ocean science reported in the first (orange), second (green) and third (blue) editions of the GOSR. The dotted line indicates 50%. Source: GOSR questionnaires.

- Female leadership in ocean science, indicated by the number of invited and keynote speakers at international conferences (2019-2025), differs regionally: Women comprised more than 50% of distinguished speakers at international conferences focused on the Arctic Ocean (60%) and Oceania (56%), while conferences addressing the Indian Ocean (19%) and Mediterranean Sea and the Black Sea (39%) regions featured fewer women speakers.
- When attendance in the Intergovernmental Oceanographic Commission (IOC) of UNESCO's OceanTeacher Global Academy online courses is considered, women are well represented in ocean science training programmes, with participation rates over 50% (Figure ES6). This suggests that among the IOC associated ocean science community women are seeking more opportunities for upskilling and professional development through the convenience of online mechanisms.

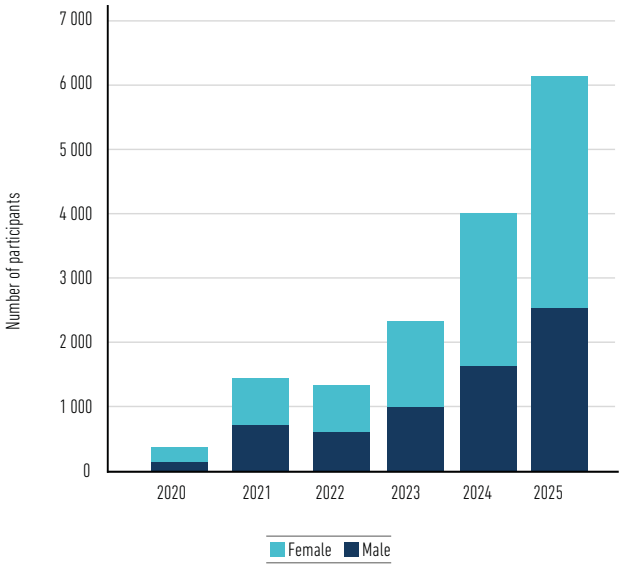


Figure ES6. Number of female and male experts participating in online OceanTeacher Global Academy courses. *Source*: The Intergovernmental Oceanographic Commission of UNESCO.

Job stability

Employment conditions in ocean science vary widely across countries: in the Philippines, less than 25% of personnel are reported as permanently employed, while in Morocco and Bulgaria more than 75% of personnel are identified as permanently employed. High percentages of temporary positions can affect career attractiveness, retention and long-term capacity, resulting in migration of trained experts to other countries and into other employment sectors.

On a positive note, 78% countries contributing to the third edition of the GOSR identify permanent employment rates above 50%. Of the 13 countries that provided permanent employment figures for both the second and third edition of the GOSR, 8 show no change over time. Among the remaining five, two countries report an increase in permanent employment, while three reported a decline.

Capacity development needs and activities

Delivery and application of ocean science information and tools require building a skilled workforce that can secure a profitable and sustainable future.

Of countries contributing to the third edition of the GOSR, the highest ranked priority needs for supporting a skilled workforce and expanding ocean science capabilities are: (i) funding; (ii) human capacity development, including an increase in the number of ocean science personnel; (iii) academic (higher) training and basic training in ocean science; and (iv) observation facilities and equipment (e.g. remote sensing equipment, buoys, tide gauges, shipboard measurements and other means of ocean observation) (**Figure ES7**). These priorities reflect those reported from the broader community in peer-reviewed literature.

Countries contributing to the GOSR identified that building such capacity is only successful when training programmes are co-designed and tailored to local and regional needs. They identified several supporting mechanisms key to capacity development, including:

- exchange programmes;
- networking and mentoring; and
- policies encouraging equal participation of all genders in ocean science.

Activities and thematic areas considered important for directing capacity development included collaborations with Indigenous communities and access to research vessels, as well as activities focused on climate change vulnerability, data management, conservation and protection of marine ecosystems, application of artificial intelligence (AI), deep sea research and underwater geohazards.

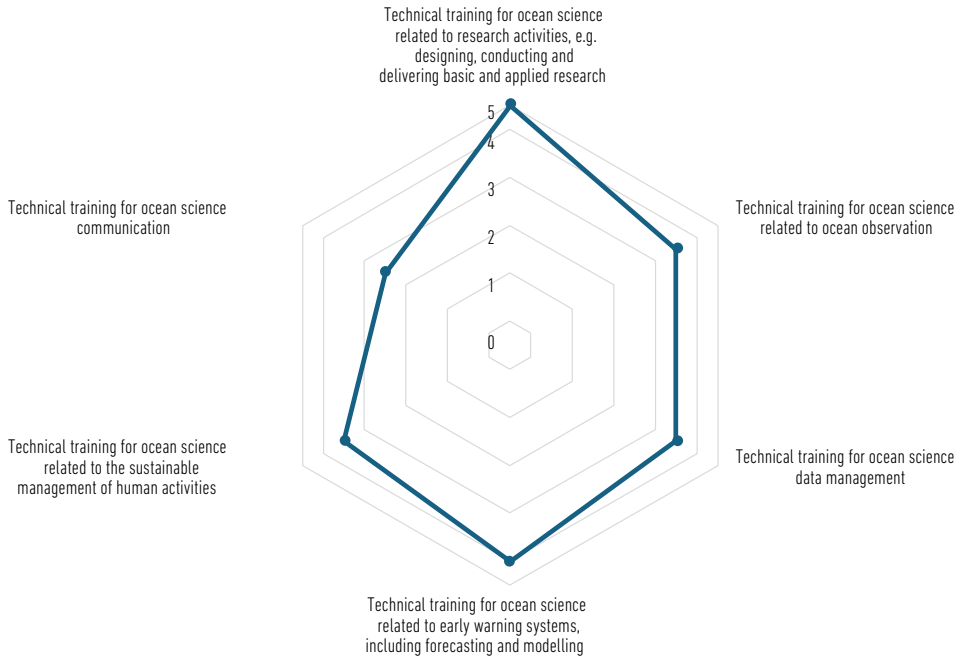


Figure ES7. Median capability development needs (1 = lowest priority, 5 = highest priority) provided by countries responding to the GOSR questionnaire (n=36). *Source*: GOSR questionnaire.

Human capacity is central to impactful ocean science, but receives uneven support across countries, resulting in limited opportunities in developing countries (e.g. Kenya and the Philippines have less than 5 ocean science researchers per million inhabitants compared to more than 300 in Portugal or 100 in Belgium), and persistent gender gaps weaken the ocean science system.

Infrastructure and technology: concentrated and costly

Ocean science relies not only on investment in people, but also on access to technical infrastructure and equipment. This includes access to a variety of ocean observation platforms and vehicles, laboratories and field stations. Investment in and access to marine technology continues to be unequal among those countries contributing to the GOSR as represented by national research vessel fleets, access to satellite data and use of emerging technologies.

Exploration of the ocean from top to bottom

Most countries contributing to the GOSR participate in ocean observation covering physical, chemical and biological parameters, using tools such as:

- buoys, floats and moorings;
- autonomous underwater vehicles and drones; and
- satellites for global monitoring

Only a small number of countries contributing to the GOSR report having infrastructure capable of exploring the open ocean:

- **10 countries operate 77% of research vessels reported.**
- **Almost 55% of research vessels reported are smaller than 24 m and therefore limited in their range** (**Figure ES8**).
- Investment in deep-sea research by countries contributing to the GOSR reflects overall patterns in ocean science capacity, with countries that have limited capacity (≤3 vessels) and lower GDPs generally not engaging in deep-sea research.
- **36 of 41 countries (88%) contributing to the GOSR use satellite data for ocean science activities**, with 39% deploying satellites independently, or contributing to the deployment of satellites.

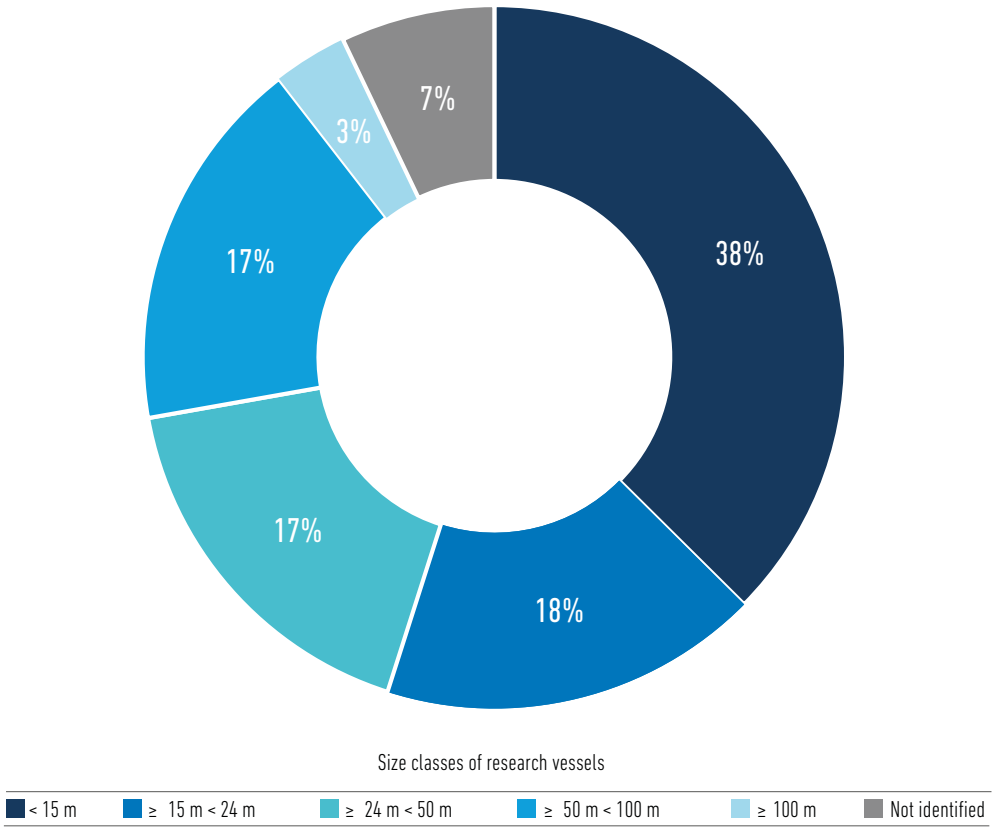


Figure ES8. Percentage of research vessels by size class (n=1058). *Source*: GOSR questionnaire.

Use of Artificial Intelligence

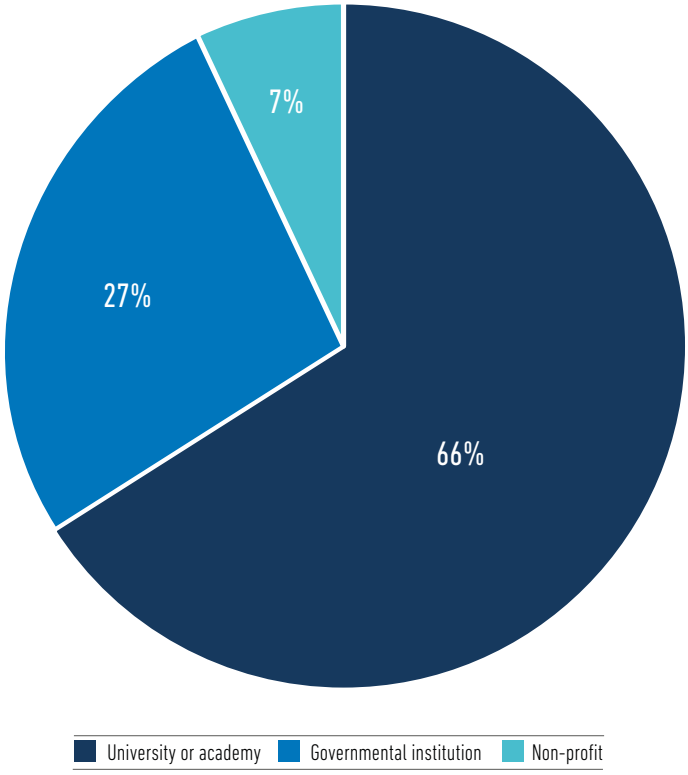
The effective use of Artificial Intelligence (AI) depends on skilled personnel for algorithm development, validation and quality control, particularly in ecological and biological applications, where curated, well-annotated datasets and expert oversight are critical to avoid biases or misinterpretation. These capabilities also underpin emerging frameworks such as Digital Twins of the Ocean and next generation sensors and autonomous platforms, enabling real-time anomaly detection and adaptive sampling.

- AI is rapidly transforming ocean science, with **69% of countries contributing to the GOSR investing in AI applications.**

Ocean science institutions

The organization and distribution of financial investment in ocean science varies across countries. This distribution influences the national organization and structure of ocean science institutions. For example, Spain and France demonstrate a very centralized organization of ocean science institutions, while Brazil implements ocean science through a range of universities and institutes.

Countries responding to the GOSR questionnaire across the three reporting periods (n=40) identify academic institutions as representing the majority of ocean science institutions (66%), followed by governmental (27%) and non-profit institutions (7%) (**Figure ES9**).



Figures ES9. Percentage of academic, governmental and non-profit institutions identified by countries questionnaires (n=40). *Source*: GOSR questionnaire.

The development of innovative tools and technology in support of ocean science and observation are advancing rapidly, with new opportunities to democratize access to ocean information and knowledge.

Ocean data: a complex and evolving ecosystem

Ocean data lies at the heart of scientific discovery and decision-making. Ocean data and information generation spans all disciplines, multiple knowledge systems and knowledge custodians. Data may be collected as part of formal scientific investigations including experiments, observations, operational activities, regulatory requirements or community-based initiatives, and its collection can be embedded in cultural practices that span centuries.

Over 75% of all countries contributing to the GOSR collect data across the ocean science disciplines of biology, physics, geology, geophysics and chemistry. Over 80% of countries identified that they collected data on human impacts such as pollution, while just under 80% collected sector-based data (including economic data). Only 45% reported that they collected social data (including demographic and value-based data).

Global, regional and national ocean data centres and data management programmes deliver data across a mix of real-time and delayed modes and in varying formats including web services, visualization platforms and virtual environments. These data centres serve multiple users, mainly policy-makers, researchers, the private sector and the public.

Despite the diversity of data being managed, archived and delivered and the users being served by data centres:

- More than **30% of countries** contributing to the third edition of the GOSR **restrict access to data, with less than 10% applying no restrictions on data access and sharing** (**Figure ES10**).
- Restrictions reported include embargo periods, legal or commercial restrictions and those related to geographic areas, or data types.

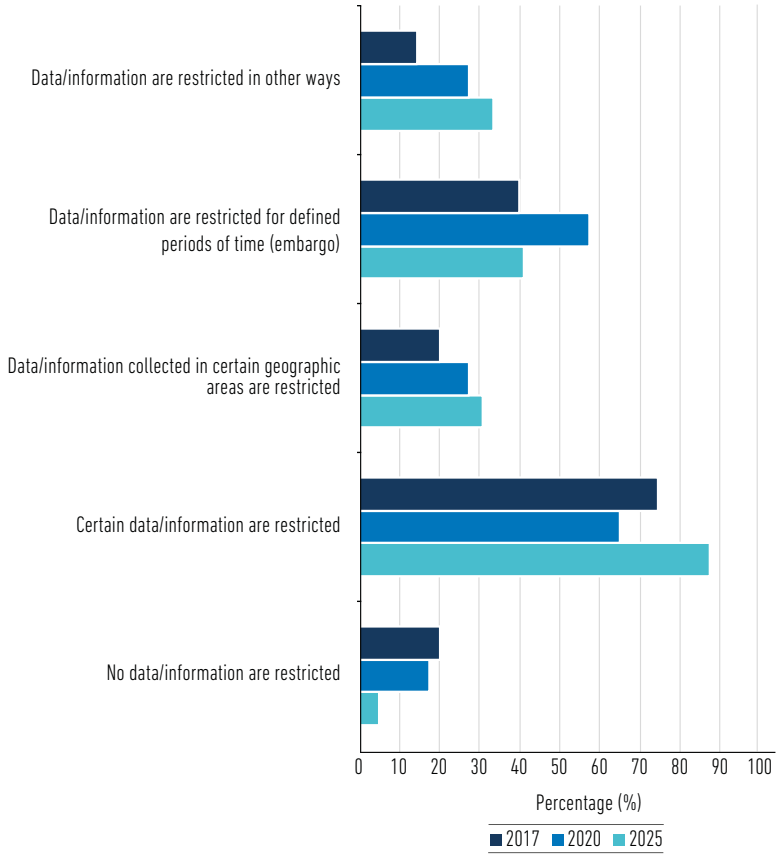


Figure ES10. Restrictions placed on data identified by IOC Member States responding to the GOSR questionnaire (%) (2017 n=36; 2020 n=44; 2025 n=39). *Source*: GOSR questionnaires.

Data are growing in diversity, volume and importance, but restrictions placed on data access occur in most countries contributing to the GOSR.

Scientific output: expansion and shifting leadership

Globally, ocean science publications continue to grow and have doubled over the last 15 years, with the COVID-19 pandemic having little overall impact on growth (**Figure ES11**). Ocean science publications now make up 4.7% of all scientific publications, compared to 4.2% 15 years ago.

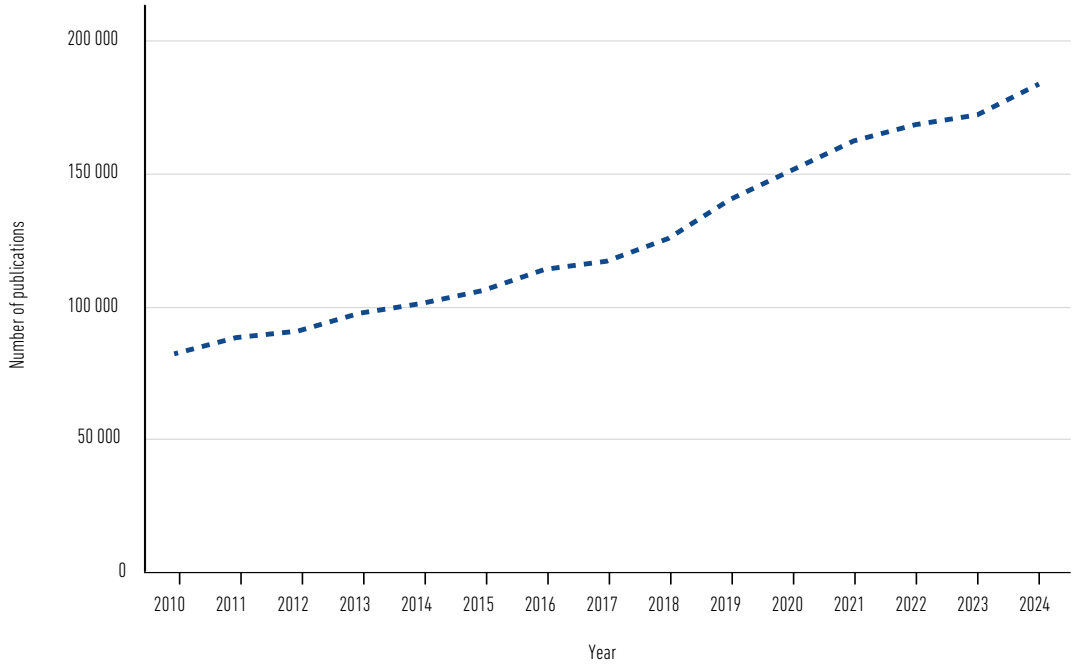


Figure ES11. Total annual global number of peer-reviewed publications with a focus on ocean science.

Geographic distribution of science outputs

- China and the USA have produced more than twice the number of peer-reviewed papers over the period 2010–2024 when compared to the number produced by the remaining top 100 publishing countries.
- China has **tripled its ocean science publication output since 2010.**
- India was the **third-largest producer of ocean science literature across 2020–2024,** doubling the number of publications reported in the first GOSR.
- Iraq, Indonesia and Uzbekistan all exceeded the global average of growth (1.62) in ocean science publications across 2010–2024, while Venezuela (0.70), the USA (1.12), Japan (1.18) and France (1.22) were below the global average.
- When normalized against the country's population, 10 Small Island Developing States (SIDS) feature among the 50 countries producing the largest numbers of peer-review publications (with Palau and Seychelles the highest of the SIDS).

Collaboration patterns

Collaborations between countries on peer-reviewed publications are strongly linked to research impact, especially for countries with limited domestic capacity.

- On average, **48% of ocean science publications published across 2010–2024 are written by authors from at least two countries** (**Figure ES12**).
- In some smaller countries, particularly SIDS and developing countries, collaboration rates associated with ocean science publications exceed **90%** (Oceania, **Figure ES12**).

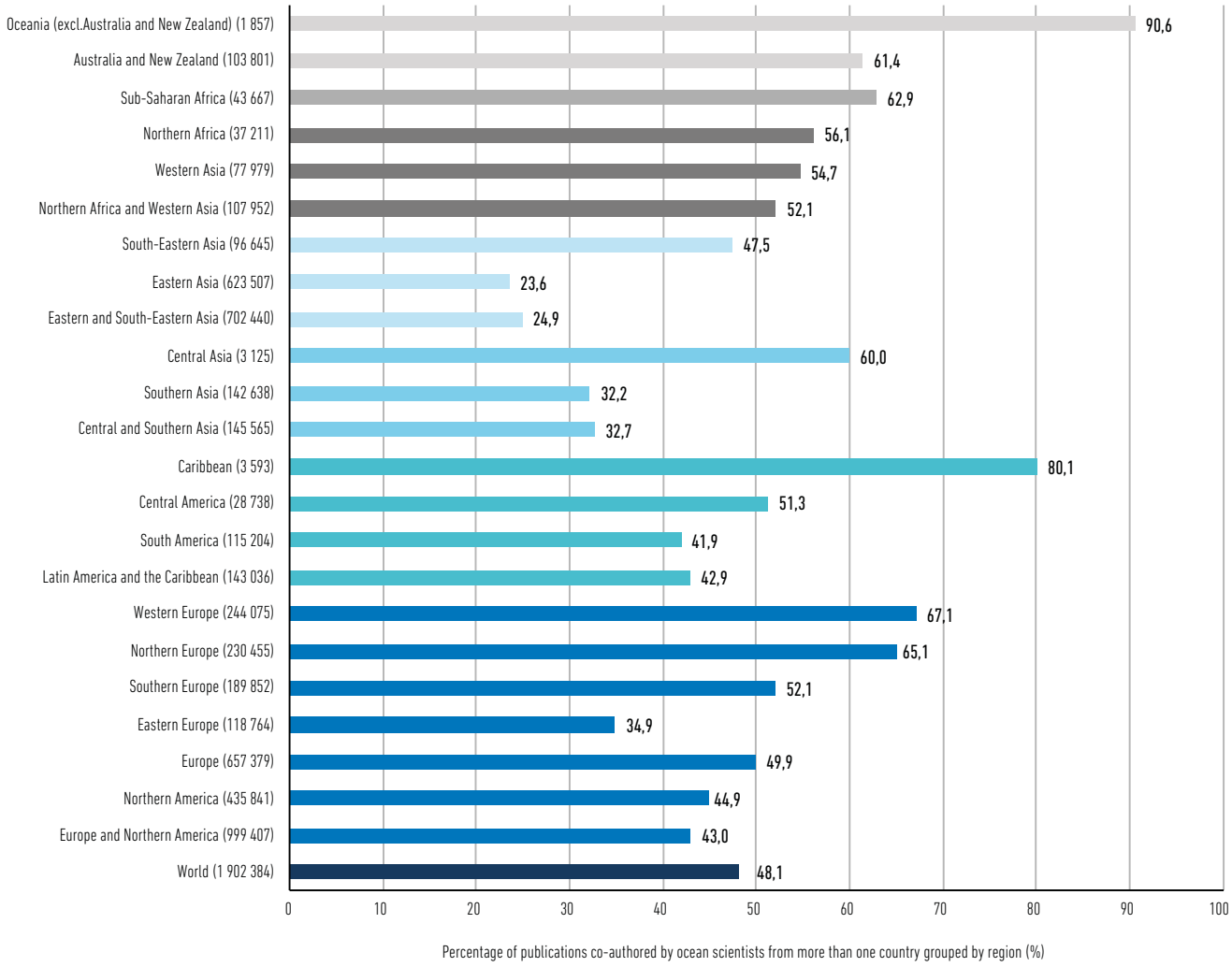


Figure ES12. The percentage of publications co-authored by ocean scientists from more than one country grouped by region. Total publication counts for each region are shown in parentheses for the period 2010–2024.

Collaborations between the public (universities and public research institutions) and private sector are considered to have positive effects on economic growth, social value and competitiveness. Countries that rank highly in public–private co-publications tend to have substantive ocean economies, reflecting higher engagement between private industry and ocean science institutions in research and development.

The outputs from ocean science are expanding globally, with new leaders emerging in the production of knowledge. Strong collaborations are being maintained and developed across different regions and new partnerships are being established with non-academic stakeholders.

From knowledge to impact

Ocean science is increasingly applied across ocean sectors. Science informs the regulation and management of sector-based ocean activities by defining ecological baselines, setting operational thresholds, guiding risk management and enabling monitoring that can inform compliance and enforcement.

National, regional and international commitments to multilateral processes require the integration of planning and management frameworks that are informed by up-to-date scientific data, and science-based products and tools. This in turn supports decision-making that balances competing uses, whilst maintaining ecosystem integrity. Strengthening the science-policy-society interface is therefore essential for converting ocean knowledge into tangible benefits for people, nature and the economy.

Key sectors

Ocean science supports decision-making directly and indirectly in:

- fisheries and aquaculture;
- shipping and maritime transport;
- tourism;
- renewable and non-renewable energy; and
- emerging sectors such as finance and insurance.

Policy relevance

Ocean science provides the evidence base for:

- marine spatial planning;
- resource management;
- climate adaptation strategies; and
- biodiversity conservation.

Achieving ocean sustainability requires broader societal transformation. It depends on engaging diverse cultures and age groups to fully recognize the vital role the ocean plays in human and planetary well-being. Fostering this level of engagement necessitates a concerted effort to advance public awareness of ocean science and its essential contributions to society. Mechanisms being used to facilitate this transformation include:

- Establishment of science-Indigenous knowledge systems, resulting in wide uptake of science outputs and co-designed community-science-based capacity development.
- Development and dissemination of strategic communication outputs tailored to non-academic needs.
- Integrating ocean science into formal education.
- Recognition and integration of cultural and natural heritage as foundational for an ocean-engaged society.

Ocean science is essential for economic and environmental decisions, but its value can be enhanced by:

- Expanding open data infrastructures to reduce barriers and promote equitable access and interoperability of ocean information.
- Enhancing science–policy interfaces through participatory decision processes and inclusive governance.
- Leveraging global frameworks – such as the UN Ocean Conference, Regional Sea Conventions and international framework reporting systems (e.g. the Sustainable Development Goals, Kunming-Montreal Global Biodiversity Framework) – to ensure continuity and coherence in science-informed decision-making.
- Integrating science into blue finance frameworks to guide sustainable investment and risk management.
- Reducing capacity gaps in developing nations via targeted training, technology transfer and sustained financial support to enable equitable uptake of ocean sciences.

Global systems and supporting collaborative efforts

Ocean science operates within a complex global governance and stakeholder system involving:

- United Nations organizations;
- intergovernmental bodies;
- regional agreements;
- national strategies;
- non-governmental organizations; and
- private sector actors.

Given the scientific and regulatory complexity of ocean management, regional and national collaborative ocean science efforts are essential bridges between international commitments and local implementation. This multistakeholder support system strengthens global research, monitoring and knowledge-sharing, helping to build capacity and ensure that challenges facing the ocean can be addressed collectively (**Figure ES13**).

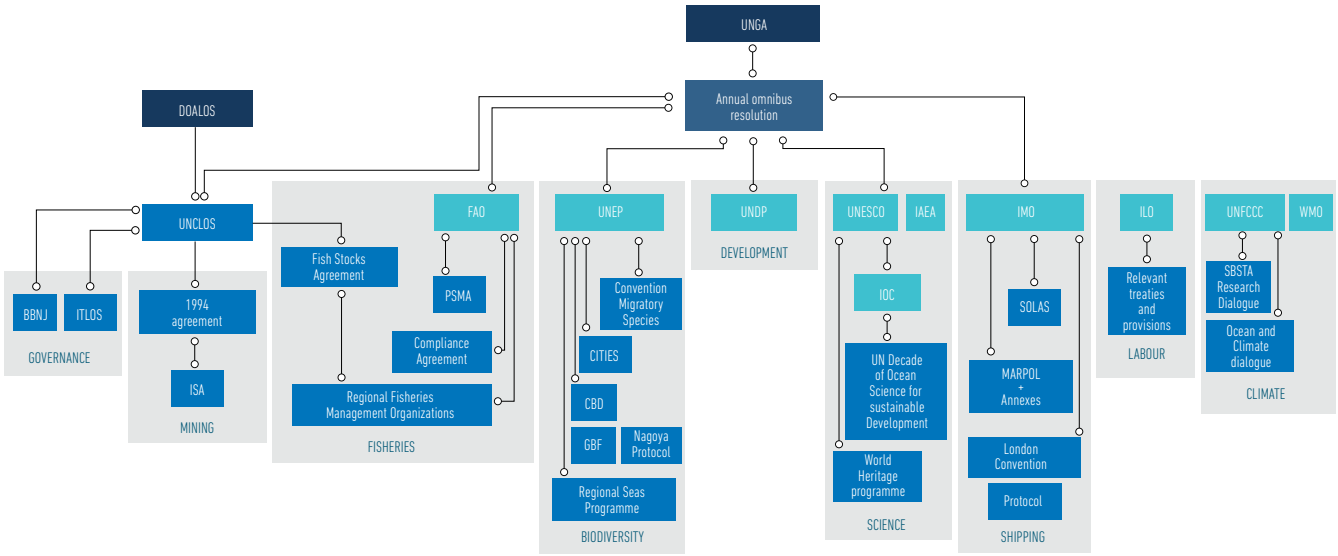


Figure ES13. Overview of UN entities and associated relevant conventions and agreements and their linkages of relevance to ocean science. *Source*: Adapted from Global Ocean Commission (2014).

Global coordination efforts

Demand for the outputs of ocean science, translated into products that can be used in policy processes, continues to expand as international target-setting frameworks and new multilateral agreements are established. As a result, there is increasing demand for ocean-science based tools and information that can facilitate:

- engagement in discussions and negotiations directly associated with frameworks and agreements;
- reporting against obligations at the national level under agreements;
- implementing strategies and policies at the national level that progress targets; and
- supporting clearing house mechanisms for knowledge, technology and data exchange.

Global initiatives such as the Ocean Decade have clearly demonstrated their ability to attain global reach and mobilization of ocean science efforts across many disciplines and thematic areas through the building of new partnerships and engagement of multiple stakeholders. Halfway through the Ocean Decade, challenges still remain, with a need to expand coordination and participation, particularly with and in SIDS and Least Developed Countries, resource mobilization (see also section on expenditure), representation from under-resourced regions and certain stakeholders including Indigenous peoples and Early Career Ocean Professionals, engagement by other UN agencies and translation of scientific outputs into policy action.

National and regional coordination

Regional multilateral and scientific efforts constitute an intermediate layer in the architecture of ocean governance, translating global commitments into coordinated scientific and management action at ecologically meaningful scales.

Regional mechanisms, such as the UN Environment Programme's Regional Seas Programme, the International Council for Exploration of the Sea (ICES), the North Pacific Science Organization (PICES), the Pacific Community (SPC), the Secretariat of the Pacific Regional Environment Programme (SPREP) and IOC's regional subsidiary bodies (IOCARIBE, IOC AFRICA, IOCINDIO and IOC-WESTPAC) enable neighbouring states that share marine ecosystems to:

- harmonize monitoring systems;
- undertake joint scientific assessments;
- develop common standards; and
- build institutional and technical capacity.

These bodies demonstrate how regional scientific cooperation can directly inform management interventions, while strengthening long-term observation and assessment systems.

However, structural gaps remain, including:

- Fragmentation between regional conventions and scientific networks. This can limit data interoperability and reduce comparability across regions.
- Variations in technical capacity that create asymmetries in participation and benefit-sharing.
- Long-term financial sustainability of observation systems, which remains uneven, particularly in developing regions.

Addressing these gaps will require enhanced coordination across regional bodies, strengthened data-sharing standards and sustained investment in equitable capacity development.

At the national level, development of overarching and sector-based strategies and associated coordination mechanisms are essential for translating global ocean commitments into domestic implementation. While the existence of a strategy indicates a country's commitment to coordinate and support ocean science, it does not automatically ensure effective knowledge production or science uptake. Countries with more mature systems typically demonstrate:

- formal interministerial coordination mechanisms;
- legal or policy mandates anchoring ocean science;
- integration with climate reporting processes (e.g. NDCs), sustainable biodiversity and ocean plans; and
- structured science–policy dialogue platforms.

Overall, national processes supporting ocean science are expanding, but remain uneven, with 66% of reporting countries having ocean science strategies.

Expanding actors

Since the publication of the first Global Ocean Science Report in 2017, the involvement of non-institutional actors in ocean science, policy and stewardship has gradually increased.

- NGOs and citizen science initiatives are filling data and coordination gaps.
- The private sector has transitioned from a passive user of ocean data to a proactive co-producer of ocean science.
- Philanthropy is evolving toward coordinated funding models.

Ocean science is becoming more collaborative and multi-actor, but coordination remains complex.

Systemic vulnerabilities

The generation of ocean science products and information is fundamentally based on secure, sustained, equitable and resilient ocean science systems built at national, regional and international scales. Vulnerabilities in such systems are driven by inequities in human capacity, unequal access to marine technology and data, lack of investment and the impact of disruptive events.

Inequality and access

As already identified, research vessels, deep-sea observatories and long-term monitoring assets are overwhelmingly concentrated in a handful of developed nations. Efforts have been made in some regions to remove barriers to collaboration that can support capacity exchange; however, even with supporting policies, the results of these efforts have been uneven. Without investment in human expertise, even the best technologies will remain underutilized and addressing the triple planetary crisis of climate change, biodiversity loss and pollution will be hampered.

Even when technology can be accessed, it may not be suitable for local conditions. Equitable access requires context-adapted and cost-effective technologies designed for diverse users and environments.

Global ocean observing infrastructure remains structurally fragile. Many observation platforms operate without redundancy, thus single-point failures disrupt essential data streams and undermine the continuity of global time series, which are essential for detecting long-term change.

Brain drain and inequitable practices

The migration of expertise from developing countries to developed countries, referred to as 'brain drain', exacerbates inequalities in capacity and can undermine efforts to increase national and regional capacity. As overall global educational attainment has risen, the negative effects of 'brain drain' in origin countries has been partially offset. However, 'parachute science' or neo-colonial science still occurs and marginalizes local scientists and communities, reducing their engagement in scientific activities, rather than including them as equitable partners in knowledge creation. Despite efforts to avoid such approaches to ocean science structural impediments within funding and governance systems, authorship and institutional representation remain, leading to inequitable representation across geographies and gender in many international initiatives and assessments.

External shocks

Disruptive events such as the COVID-19 pandemic, shifting geopolitics, conflict, economic downturns and changes in national priorities and policies can impact ocean science globally. Studies on the impact of the COVID-19 pandemic on ocean science have identified that while scientists are well placed to cope with shocks, and the pandemic stimulated educational innovations, concerns remain regarding structural inequalities, participatory processes and justice issues that limit transformative change. Continuing geopolitical situations across multiple regions have had direct impacts on local ocean scientists and associated ocean science infrastructure: researchers have emigrated from regions of conflict or have moved to other professions, while ocean science infrastructure has been compromised or destroyed. Changing priorities at the national level emphasize the importance of regional and global shared science support structures, dispersed funding models for such structures and the need for enhanced and sustained support for international collaboration.

The ocean science system is vulnerable to shocks and requires more equitable and resilient structures.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Priorities for the future

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Countries contributing to the GOSR consistently identified four urgent priorities for delivering effective ocean science that supports ocean economies and sustains ocean ecosystems:

1. **Increased and better-coordinated funding.** Investment is foundational and must increase equitably. Public investment, supplemented by philanthropy, private sector engagement and blended finance, must be integrated into long-term, coordinated strategies.
2. **Strengthening human capacity and workforce development**. Human capacity and access to infrastructure remain critical bottlenecks in advancing the protection and sustainable use of the ocean. Without addressing inequalities in capacity, scientific systems risk stagnation despite technological advances.
3. **Collaboration is essential but increasingly and rapidly fragile.** Strengthened national, regional and global coordination mechanisms are essential for facilitating knowledge, capacity and technology exchange and sharing, thereby reducing fundamental inequities.
4. **Improving observation systems and infrastructure.** Investment in emerging platforms, integrated modelling systems, data assimilation and open-access digital infrastructure will accelerate discovery, analysis and delivery of actionable knowledge.

Additional priorities include:

- enhancing data sharing and integration;
- promoting equitable partnerships; and
- expanding access to technology and AI.

Encouraging trends include:

- **82% of countries contributing to the GOSR participate in capacity-building partnerships;**
- there is a growing role of women in training and development; and
- there is increasing engagement of private sector and philanthropy.

Conclusion: closing the gap between ambition and reality

Ocean science is more important than ever. It underpins our ability to respond to climate change, protect biodiversity and build a sustainable ocean economy.

The Global Ocean Science Report details an ocean science system that is evolving; progress is evident in expanding research scope, interdisciplinarity and the growing relevance of ocean knowledge to policy. Yet structural vulnerabilities, capacity gaps and uneven access to technology persist.

The next five years will be decisive: they will determine whether the ambitions of the Ocean Decade can be realized and whether global ocean science systems are equipped to support a sustainable, equitable and resilient ocean for future generations. Transformative ocean science requires sustained investment, inclusive capacity development, strengthened collaboration, open and inclusive knowledge networks and strategic deployment of emerging technologies.

Global Ocean Science Report

Investing in Sustainable Ocean Solutions

The Global Ocean Science Report (GOSR) tracks the status and trends of global ocean science capacity, investment, outputs and the global connections that facilitate both the generation and use of ocean science knowledge and information.

The third edition of the GOSR builds on the findings presented in the first and second editions of the report. It extends time series on investment and scientific capacities and activities, enabling broader analysis of trends, resilience, and vulnerability. The GOSR therefore provides the most comprehensive assessment of ocean science to date, covering not only how knowledge is produced, but also how it is shared, applied, and translated into societal benefits.

Turning ocean science and knowledge into action.

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