



unesco

A photograph of a wooden pier extending into the ocean at sunset. The sky is a mix of orange, yellow, and blue. Several people are silhouetted on the pier. A flag flies from a pole on the pier. The water in the foreground is dark blue with gentle ripples.

UNESCO Ocean Programmes

Contents

Foreword by Director-General Audrey Azoulay	5
The Decade of Ocean Science for Sustainable Development	6
International ocean summits in 2022	6
Ocean and UNESCO action in numbers	7
Measure and Understand	9
Global Ocean Observing System	9
Ocean Mapping - General Bathymetric Chart of the Ocean	10
Ocean Biodiversity Information System	13
Ocean Acidification	14
Data and Information	17
Alert	18
Global Tsunami Warning System	18
Harmful Algal Bloom Programme	21
Evaluate and Manage	22
Flagship Ocean Reports	22
Managing the ocean and coasts: Marine Spatial Planning	24
Educate, Enable	26
Ocean Teacher Global Academy	26
Ocean Literacy	27
Protect, Transmit	29
50 UNESCO World Heritage Marine Sites	29
Resilient Reef Initiative	29
Biosphere Reserves	30
Geoparks	30
Photography	35
Videography	35



Foreword by Director-General Audrey Azoulay

The ocean is where all life began – it shelters 157,000 known species and up to a million species that have yet to be discovered. Earth could not breathe without the ocean – this blue lung absorbs a quarter of global carbon dioxide emissions. In addition, 3 billion people, almost half of humanity, depend directly on the ocean for their livelihoods.



Today, however, the future of the ocean is in jeopardy. Climate change is taking its toll. Waters are warming and becoming more acidic; ecosystems are suffering. Over the past 200 years, the planet has lost half of its coral reef cover, as well as three quarters of its mangrove forests. According to a UNESCO report, the ocean may soon stop absorbing carbon and emit it instead. This would be a disaster, to say the least.

We cannot rise to these challenges if we remain ignorant of the ocean. Today, only 20% of the ocean's depths have been explored, even though it covers 71% of the world's surface. Ocean research remains poorly funded, only receiving a tiny fraction – an average of less than 2 per cent – of national research budgets.

At a time when humans are setting their sights on Mars, we need to explore the ocean, the world's least-known continent. We must redouble our efforts to understand these depths, so we can deliver lasting solutions to the threats they face. And, because the world has the ocean in common, the only effective way we can do this is through multilateralism.

UNESCO works towards this goal. With its Intergovernmental Oceanographic Commission joined by 150 Member States, and its expertise in the culture and education fields, UNESCO enables coordinated actions by governments, scientists, the private sector, civil society and other UN organizations. Together, we created the tsunami warnings system, we map the deep ocean, identify species, work to ensure that environmental education and ocean literacy are included in school curricula, and protect underwater heritage.

UNESCO is also the guardian of unique ocean sites, which are home to critical biodiversity, geological processes and incomparable beauty. We now have 232 marine Biosphere Reserves and 50 marine World Heritage sites of Outstanding Universal Value across the globe.

But there is still a lot to do. Today, UNESCO is ramping up this collective mobilization for the ocean, by leading the United Nations Decade of Ocean Science for Sustainable Development, from 2021 to 2030. In this context, several major international summits will take place this year, amplifying our efforts to better understand – and therefore better protect – the ocean.

There are ten years left for humanity to understand that the Earth is first and foremost an ocean. Our fate depends on the way we care for it together.

The Decade of Ocean Science for Sustainable Development

UNESCO leads the United Nations Decade of Ocean Science for Sustainable Development, from 2021 to 2030. The Decade provides a common framework to ensure that ocean science can fully support countries to achieve the 2030 Agenda for Sustainable Development.

Over 361 Decade Actions have been officially endorsed, propelling action amongst ocean actors to generate more and improved ocean science and turn that knowledge into transformative solutions for sustainable development.

International ocean summits in 2022

This year, the Decade is reflected in the organization of three major international summits that will amplify the collective mobilization.

- **One Ocean Summit** (Brest, France)
– 9 February to 11 February
- **Our Ocean Conference** (Palau, United States)
– 13 April and 14 April
- **UN Ocean Conference** (Lisbon, Portugal)
– 27 June to 1 July

Ocean and UNESCO action in numbers

1960

Birth of UNESCO's Intergovernmental Oceanographic Commission (IOC)

150

Member States of the IOC-UNESCO that helps governments coordinate scientific marine research programmes, ocean services and related activities such as capacity development. At the national level the IOC-UNESCO works with marine, ocean and coastal management agencies to ensure that policymakers have access to the best possible ocean science and services.

\$3 Trillion

The projected value of ocean economy by 2030

>20%

of the seabed that has been mapped in high resolution. Through the General Bathymetric Chart of the Ocean (GBCO), UNESCO is mobilizing governments, the tech industry and global experts to map the ocean floor in order to better understand and manage its resources and protect its biodiversity.

3,859

Argo profiling floats provide real-time data for ocean services, including seasonal forecasts, climate research and monitoring of the marine ecosystem's health and deep ocean variability.

8,211

in situ ocean observing platforms that continuously monitor the global ocean.

100 to 150%

projected increase in average acidity of the global ocean by 2100 compared to pre-industrial levels. Such an increase will have dramatic consequences for marine life. Ocean acidification measurements coordinated by UNESCO indicate that over the past 30 years, global ocean acidity grew by 26% compared to pre-industrial times.

23%

of humankind's carbon dioxide emissions are absorbed by the ocean annually.

156,789

marine species recorded in the UNESCO Ocean Biodiversity Information System (OBIS).

17

OceanTeacher Global Academy Regional and Specialized Training Centres delivering customized training to ocean experts and professionals to increase national and regional capacity in coastal and marine sciences, services and management.

232

UNESCO's marine biosphere reserves

50

marine World Heritage sites of Outstanding Universal Value

Ocean Decade Challenges



Understand and map land- and sea-based sources of pollutants and contaminants and their potential impacts on human health and ocean ecosystems, and develop solutions to remove or mitigate them.



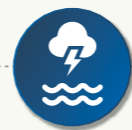
Understand the effects of multiple stressors on ocean ecosystems, and develop solutions to monitor, protect, manage and restore ecosystems and their biodiversity under changing environmental, social and climate conditions.



Generate knowledge, support innovation and develop solutions to optimize the role of the ocean in sustainably feeding the world's population under changing environmental, social and climate conditions.



Generate knowledge, support innovation and develop solutions for equitable and sustainable development of the ocean economy under changing environmental, social and climate conditions.



Enhance understanding of the ocean-climate nexus and generate knowledge and solutions to mitigate, adapt and build resilience to the effects of climate change across all geographies and at all scales, and to improve services including predictions for the ocean, climate and weather.



Enhance multi-hazard early warning services for all geophysical, ecological, biological, weather, climate and anthropogenic related ocean and coastal hazards, and mainstream community preparedness and resilience.



Ensure a sustainable ocean observing system across all ocean basins that delivers accessible, timely and actionable data and information to all users.



Through multi-stakeholder collaboration, develop a comprehensive digital representation of the ocean, including a dynamic ocean map, which provides free and open access for exploring, discovering and visualizing past, current and future ocean conditions in a manner relevant to diverse stakeholders.



Ensure comprehensive capacity development and equitable access to data, information, knowledge and technology across all aspects of ocean science and for all stakeholders.



Ensure that the multiple values and services of the ocean for human well-being, culture, and sustainable development are widely understood, and identify and overcome barriers to behaviour change required for a step change in humanity's relationship with the ocean.



Action Spotlight: Improving Management of the Great Barrier Reef (Australia)

Australia's Integrated Marine Observing System (IMOS) is one of 13 GOOS Regional Alliances. It provides a wide range of satellite and *in situ* observations that are used to support marine management services for Australia's iconic Great Barrier Reef, which is a UNESCO World Heritage site.

The Great Barrier reef Marine Park Authority uses observation data from IMOS to support the development of the eReefs oceanographic model.

This model also incorporates monitoring data to provide managers with information on water quality, sea surface temperature and other conditions across the Great Barrier Reef from estuaries and lagoons to the open sea.

The eReefs model is used in the Great Barrier Reef World Heritage Area to develop scenarios to determine how changing farm practices can improve water quality in the Great Barrier Reef lagoon and the health of seagrass and

corals. It also helps assess and predict the cumulative impacts of multiple pressures facing the Reef, such as extreme weather and bleaching, and helps guide strategic investment in reef recovery.

It is in particular on the basis of this very precise scientific system that the experts of the UNESCO World Heritage Center alerted Australia in 2021 to the urgency of improving the protection of the Great Barrier Reef.

Measure and Understand

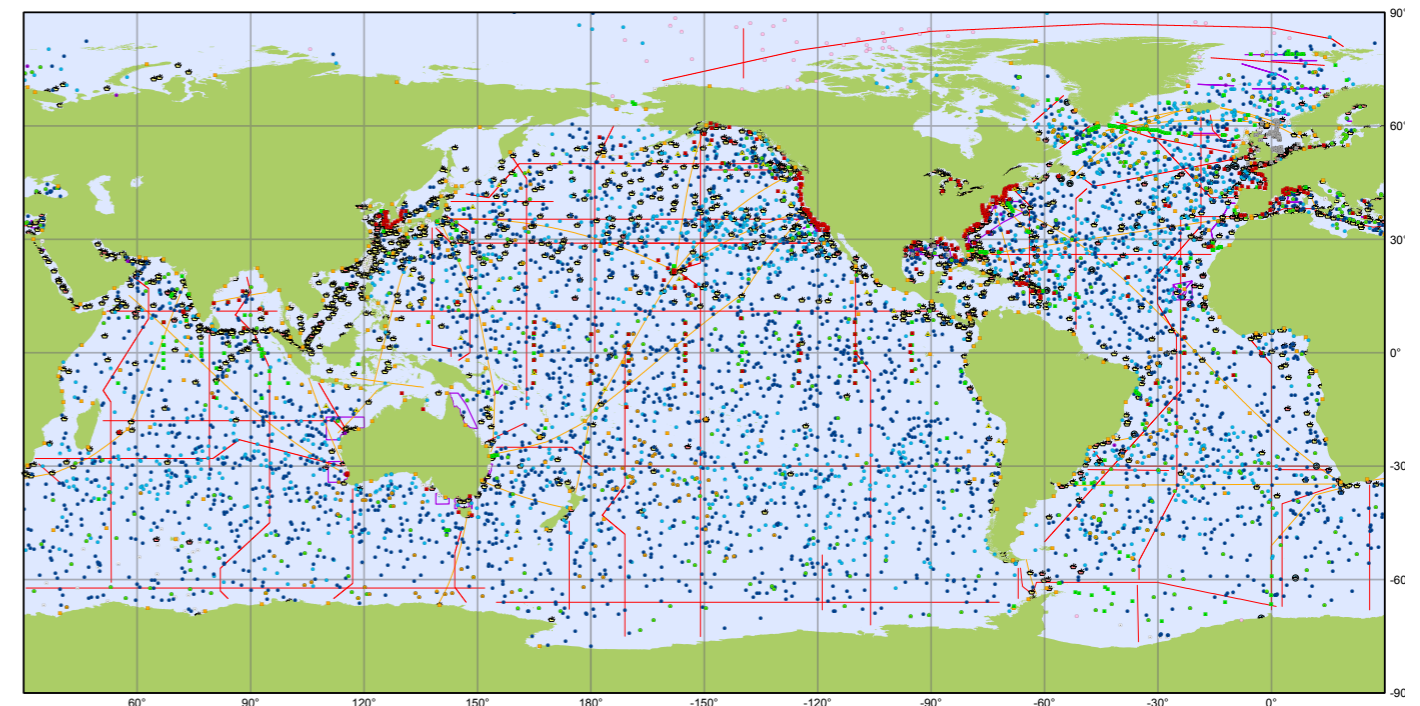
Global Ocean Observing System

The Global Ocean Observing System (GOOS) is a collaborative platform that continuously delivers ocean data to IOC-UNESCO Member States. Coordinated by the IOC-UNESCO and its partners, GOOS provides information that supports a wide range of services such as climate research, ocean forecasts, and even search and rescue operations, such as efforts to find the wreckage of airplanes like Malaysian Airlines flight MH370, for example.

The intergovernmental coordination supported by GOOS means that all IOC-UNESCO Member States benefit from a combined global investment in ocean observations of around a billion dollars every year. Many studies suggest there is a significant return on this investment across multiple sectors of the global economy. In the United States alone, it is estimated that the improved El Niño forecasting supported by information from GOOS could be worth at least \$100 million a year to the producers of staples such as wheat and corn.

Through an interconnected system of ocean data collection platforms, including tide gauges, research and commercial ships, ocean buoys, the Argo array of drifting floats, and animal-tracking devices, GOOS monitors physical data such as temperature and salinity, surface winds, and biological and biogeochemical variables such as plant and animal plankton, oxygen and carbon.

This global system connects experts working across all aspects of ocean observations but it also relies on the voluntary support of scientists, researchers and marine managers to maximize the impact of collected data and turn it into vital knowledge 'products' such as climate and weather forecasts. GOOS also serves as the ocean component of the Global Climate Observing System (GCOS), which supports the work of the Intergovernmental Panel on Climate Change (IPCC).



Global ocean observing system

December 2021

- In situ operational platforms monitored by OceanOPS
- | | | | |
|---|--|---|---|
| <ul style="list-style-type: none"> ● Core floats - Argo ● Deep floats - Argo ● Biogeochemistry floats - Argo ● Underwater gliders - OceanGliders ● Drifting buoys - DBCP | <ul style="list-style-type: none"> ● Polar buoys - DBCP ○ Animal borne sensors ▲ Tsunameters - DBCP ■ Offshore platforms - DBCP ■ Moored buoys - DBCP | <ul style="list-style-type: none"> ■ Ocean reference stations - OceansITES ■ Sea level gauges - GLOSS ■ High Frequency radars ■ Manned weather stations - SOT/VOS ■ Automated weather stations - SOT/VOS | <ul style="list-style-type: none"> ● Radiosondes - SOT/ASAP ● Repeat hydrography - GO-SHIP ● eXpendable BathyThermographs - SOT/SOOP ● Sampled sites - OceanGliders |
|---|--|---|---|

Generated by ocean-ops.org, 2022-01-06
Projection: World Plate Carree (-150,0000)

Ocean Mapping - General Bathymetric Chart of the Ocean

How deep is the ocean? How tall are the so-called “seafloor mountains”? What lies in the still largely unexplored depths of the ocean? These are just a few of the fundamental questions that the General Bathymetric Chart of the Ocean (GEBCO) seeks to answer, aiming to provide the most authoritative publicly-available bathymetry of the global ocean.

Knowing the depth and shape of the seafloor is fundamental to understanding ocean circulation, tides, fishing resources, sediment transport, environmental change, underwater geo-hazards, forecasting tsunamis, planning infrastructure construction and maintenance, cable and pipeline routing and much more.

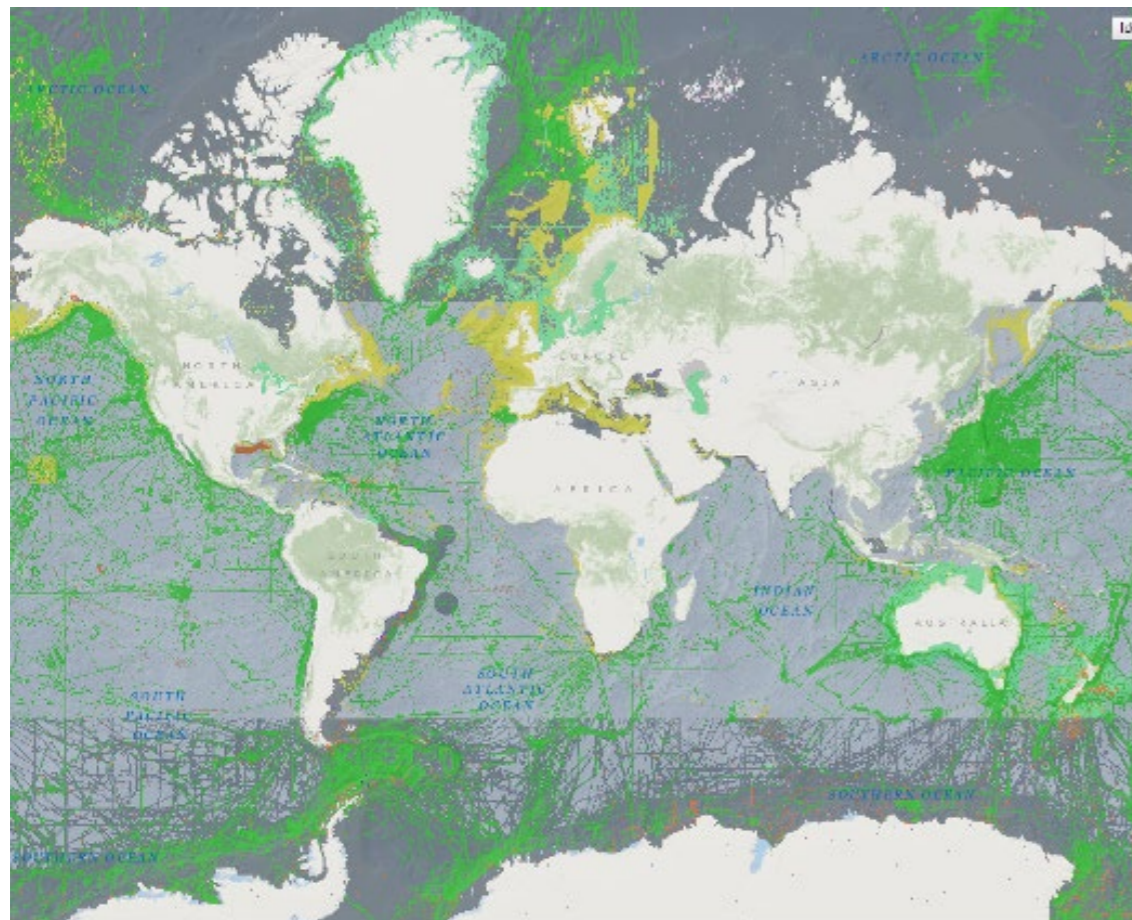
More than half of the world’s population consumes seafood as a major staple. But how can we sustain and develop the blue economy (fisheries, aquaculture, energy, mineral extraction, tourism, commerce, and shipping) with data about less than 20% of the seafloor?

UNESCO is therefore committed to coordinating international efforts in this field to accelerate mapping. Audrey Azoulay, Director General of UNESCO, will announce the new goals for 2030 during the One Ocean Summit taking place in Brest (France) from February 9 to 11.

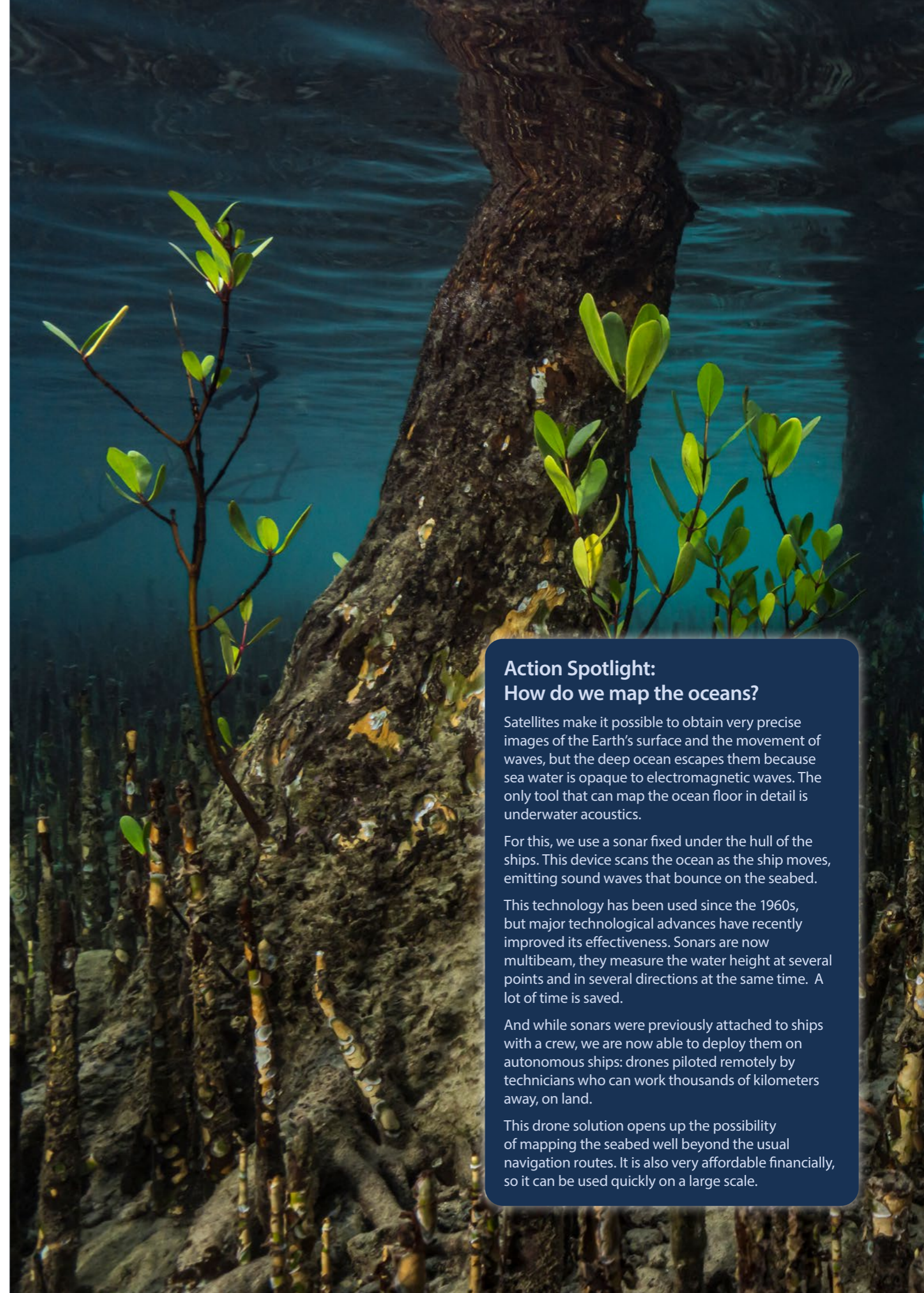
Main benefits from mapping the ocean floor in high resolution:

- Identify fish habitats and fish populations
- Identify sites capable of supporting renewable energy projects.
- Protect natural assets like coral reefs and beaches.
- Protect coastal populations. Approximately 3 billion people live within 20 km of a coastline, and more than 600 million people live less than ten meters above mean sea level. With tsunamis and coastal inundation becoming increasingly regular and impactful, understanding more of what our seafloor looks like will save lives. Respond to disasters and emergencies. Whether it is Malaysia Airlines Flight 370, the BP Deepwater Horizon Spill, or any shipwreck, mapping the seafloor allows our emergency and disaster responders to perform their job efficiently and quickly.

Global Map: Ocean floor mapping efforts



© GEBCO



Action Spotlight: How do we map the oceans?

Satellites make it possible to obtain very precise images of the Earth’s surface and the movement of waves, but the deep ocean escapes them because sea water is opaque to electromagnetic waves. The only tool that can map the ocean floor in detail is underwater acoustics.

For this, we use a sonar fixed under the hull of the ships. This device scans the ocean as the ship moves, emitting sound waves that bounce on the seabed.

This technology has been used since the 1960s, but major technological advances have recently improved its effectiveness. Sonars are now multibeam, they measure the water height at several points and in several directions at the same time. A lot of time is saved.

And while sonars were previously attached to ships with a crew, we are now able to deploy them on autonomous ships: drones piloted remotely by technicians who can work thousands of kilometers away, on land.

This drone solution opens up the possibility of mapping the seabed well beyond the usual navigation routes. It is also very affordable financially, so it can be used quickly on a large scale.



Ocean Biodiversity Information System

The Ocean Biodiversity Information System (OBIS) is a global open-access data and information clearing-house on marine biodiversity for science, conservation and sustainable development.

OBIS is enriched by the contribution of thousands of scientists who collaborate with data managers to make data available for research, management and public awareness.

This system: it integrates quality-controls and provides access to over 60 million occurrence records of 135,000 different marine species and that number is growing by millions every year.

It is working to support the protection of marine ecosystems by helping to identify hotspots of marine biodiversity and large-scale ecological patterns in all ocean basins.

OBIS is not owned by any one nation but rather it is contributed to collectively to inform individual and collaborative national decisions.

For example, scientists from the United States NOAA's National Marine Fisheries Service, used OBIS data to assess 82 fish species across a range of functions and habitat requirements in terms of their vulnerability to climate change.

By drawing on these data they found that the highest vulnerability was among benthic, bottom dwelling species, and diadromous species that migrate between saltwater and freshwater. This allows scientists to issue clearer policy recommendations.

Action Spotlight: Using DNA to improve the management of UNESCO World Heritage Marine Sites

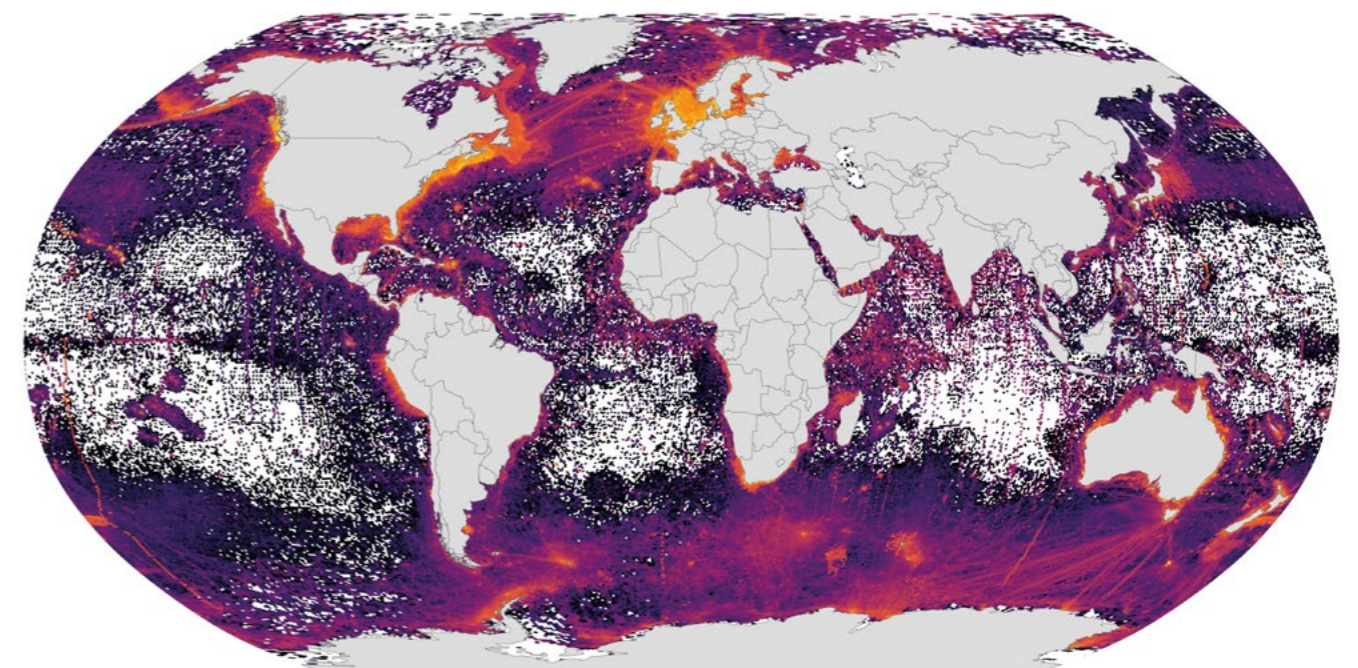
At the end of 2021, UNESCO launched an ambitious collaboration between its network of 50 World Heritage Marine Sites and OBIS to understand and monitor ocean biodiversity based on DNA research. It.

Local residents will participate to collect genetic material from waste, mucus or the cells of fish to send to laboratories to be analyzed and sequenced. These data will be centralized on a platform with free access for scientists, site managers and all interested citizens to strengthen the protection of the ocean together.

This programme will help measure the vulnerability of marine biodiversity to climate change and the impacts of that change on the migration patterns of marine life. It will inform ongoing efforts to protect these marine ecosystems and ensure future generations continue to enjoy the services they provide.

Coverage of Biodiversity Data in the Ocean Biodiversity Information System

Global Map: Coverage of Biodiversity Data in the Ocean Biodiversity Information System



Ocean Acidification

UNESCO highlighted in 2021 the role of the ocean since the industrial revolution as a sink for carbon generated by human activity. Indeed, without ocean and land sinks, atmospheric CO₂ levels would already be close to 600 ppm (parts per million), 50% higher than the 410 ppm recorded in 2019.

Every year the ocean absorbs about a quarter of man-made carbon dioxide (CO₂) emissions, which dissolve in seawater. But this phenomenon is not without problems because it increases the ocean water's acidity. This increase in acidity disrupts the chemistry of the ocean and has adverse effects on many marine species.

This is extremely concerning for communities in places like Southeast Asia where up to 70-90% of fisheries are dependent on coral reefs while rising acidity dissolves the skeletons of corals and the shells of molluscs. Because waters in the Polar Regions are already naturally rich in CO₂, the Arctic Ocean is also one of the first areas affected by ocean acidification.

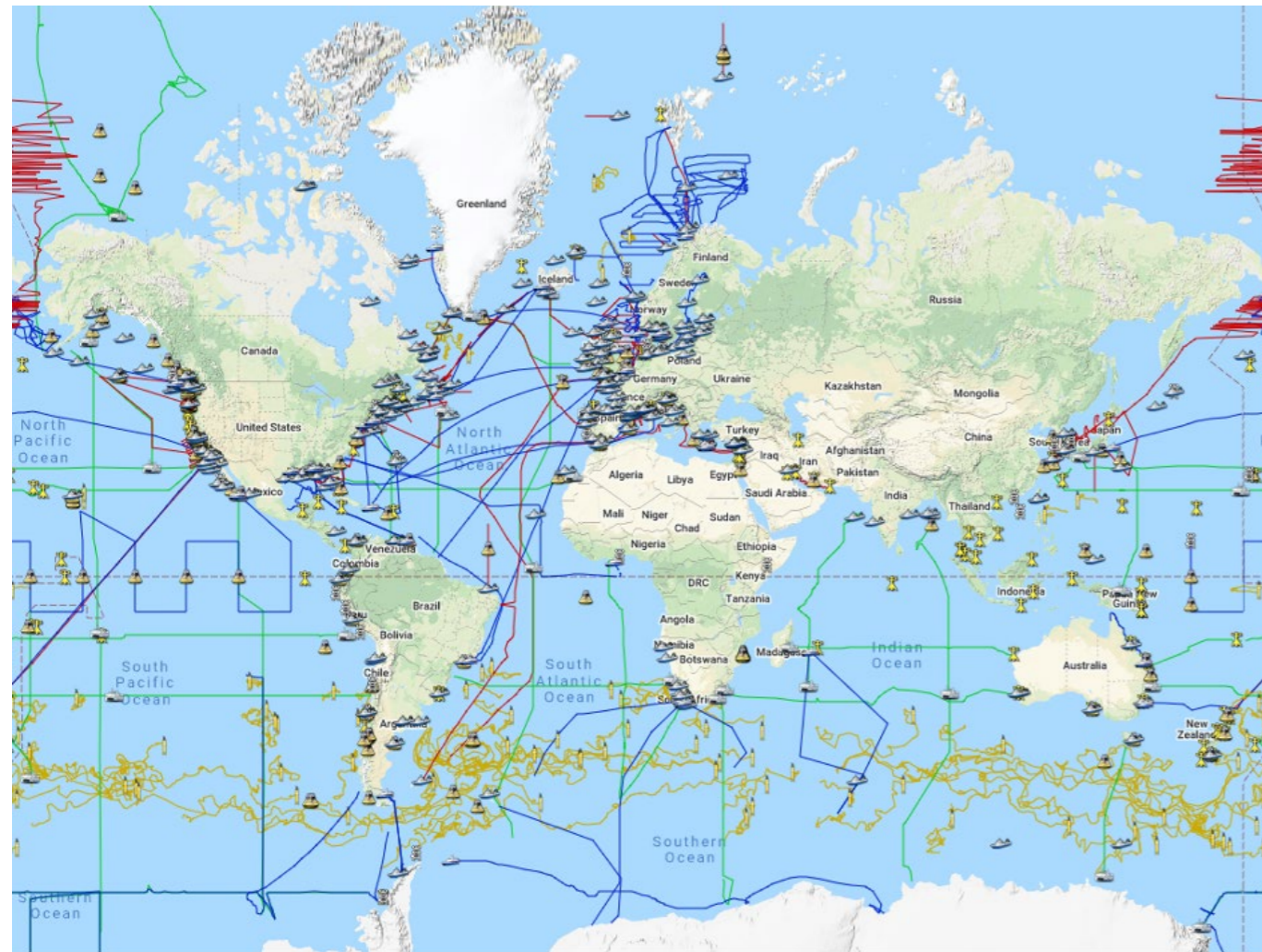
While national observation programmes are now emerging in several countries, their value is greatly enhanced when they are brought together at global and regional levels.

UNESCO is central here, bringing countries together, sharing knowledge and facilitating responses.

Since 2012, UNESCO co-sponsors the Global Ocean Acidification Observing Network (GOA-ON) and provides one third of its staff.

It brings together scientists, ocean managers and policymakers who are working on the same problem and have common techniques and ways of reporting data to ensure it can be compared across different regions.

These searches are then used by the UNESCO's programme Ocean Acidification Research for Sustainability (OARS) to identify measures to mitigate ocean acidification.



© UNESCO / Global Ocean Acidification Observing Network (GOA-ON)

Action Spotlight: Addressing Ocean Acidification in the Western Pacific

The IOC-UNESCO Sub-commission for the Western Pacific (WESTPAC) has been instrumental in organizing training for scientists in the region to help countries improve monitoring and tracking of changes in coral reef ecosystems due to an acidification.

WESTPAC, which has 22 Member States from the eastern Indian Ocean to the islands of the South Pacific, promotes efforts to address ocean acidification in a region where the issue is still very poorly understood due to lack of research and long-term monitoring.

Regional and national fisheries managers and policymakers need data-based projections on the future impacts of ocean acidification on marine ecosystems, especially on coral reefs, to develop effective long-term mitigation and adaptation strategies for communities.

WESTPAC has been focusing on standardizing approaches to monitor the ecological impacts of ocean acidification on coral reef ecosystems across the region, building a global network of research and monitoring which can generate data and information in a systematic, consistent and comparable manner.



Data and Information

Since 1961, the IOC's International Oceanographic Data and Information Exchange (IODE) has enabled researchers to exchange oceanographic data and information across all parts of the globe. Through the National Oceanographic Data Centres and Associate Data Units across the globe (68 Member States), the IODE network has collected millions of ocean observations and many scientists rely on this data to address key ocean challenges.

IODE supports a global community of over 100 National Oceanographic Data Centres (NODCs), Associate Data Units, and Associate Information Units, including an increasing number of research groups, projects, programmes and institutions managing key ocean data. The world's largest repository of marine biodiversity data, the Ocean Biodiversity Information System (OBIS) is also a part of the IODE network.

Individual oceanographic research data sets are often relatively small in size, but when considered together they can support large research questions. Data contributed from governments via the IODE network can be integrated and analysed as a whole.

IODE also directly supports a community of librarians and other marine information professionals who have become increasingly needed in guiding users through a growing forest of internet-based marine information sources. The creation of E-document repositories is now also helping to provide full text access to science publications.

The IODE also provides training for marine information specialists, particularly from developing countries, through the OceanTeacher training system (see dedicated section).

Action Spotlight: Advancing Ocean Data and Information Exchange in Africa

For many African countries, UNESCO's IODE plays a critical role in developing much needed capacity in data and information management. An array of national data centres have come into existence since the late 1990's thanks to IODE's Ocean Data and Information Network for East Africa (ODINEA) which later evolved into the Ocean Data and Information Network for Africa (ODINAFRICA). As one of IODE's most successful projects, ODINAFRICA brings together more than 40 marine related institutions from 25 countries in Africa ensuring that ocean and coastal information is readily available in an easily understandable format.



Alert

Global Tsunami Warning System

UNESCO coordinates the Global Tsunami Warning System, which covers all major ocean regions (Pacific, North Atlantic and Mediterranean, Indian, Caribbean) and plays a critical role in saving lives and minimizing damages to vulnerable coastal communities.

With this system, UNESCO quickly alerts Member States of the dangers when a tsunami occurs, but it also works upstream of tsunamis to train populations.

Action Spotlight: Supporting India's Tsunami Readiness

The Tsunami Ready programme seeks to build resilient communities and protect life, livelihoods, and property from tsunamis in different regions. In August 2020, India became the first country to implement 'Tsunami Ready' in the Indian Ocean Region. Two villages in the Odisha State and – Venkatraipur in Ganjam District and Noliassahi in Jagatsingpur District – received the IOC-UNESCO Certificate of Recognition and Certificate of Appreciation awards for meeting the 11-point Tsunami Ready criteria, including the development of a community tsunami risk reduction plan, designated and mapped tsunami hazard zones, public display of tsunami information, easily understood tsunami evacuation maps, the development of outreach and public education materials, to name but some of the measures required.

UNESCO first established the Pacific Tsunami Warning System in 1965 and, following the 2004 tsunami, it was tasked with coordinating the development of three additional tsunami warning and mitigation systems for the Indian Ocean, the Caribbean and the Northeastern Atlantic, and the Mediterranean and Connected Seas. Many of IOC-UNESCO's Member States have made significant investments in the development and operation of these new regional tsunami warning systems.

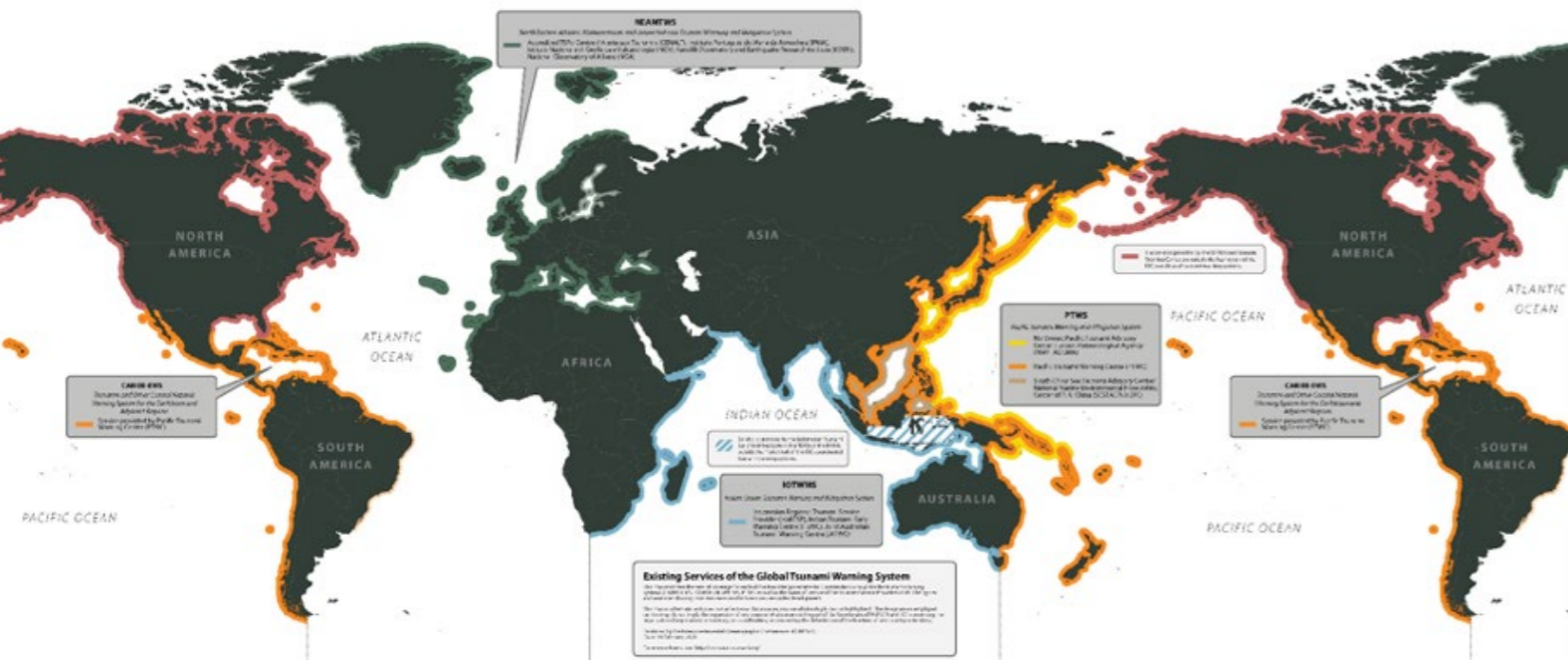
Built as a response to the tragic 2004 Indian Ocean Tsunami, the Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) cost approximately \$450 million to establish and \$50 to \$100 million annually to operate and maintain.

The Tsunami Early Warning and Mitigation System in the Northeastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS) serves 39 countries with estimated coastal populations totalling 130 million people. These numbers swell during the summer tourist season.

Another major recent success has been the development of the Caribbean and Adjacent Regions Early Warning System (CARIBE EWS). Although the tsunami threat was widely under-recognized in this basin prior to 2004, the annual tsunami exercise, CARIBE WAVE, has experienced a dramatic expansion in community participation.

In 2019 more than 800,000 participants from all the CARIBE EWS Member States took part in this exercise. Nevertheless, only 11 of the 48 CARIBE EWS States and territories are recognized as Tsunami Ready, demonstrating that much work remains to be done.

Global Map: Global Tsunami Warning System



Action Spotlight: Eruption in Tonga: how the warning system protected populations

On 15 January 2022, a volcanic eruption on the island of Hunga-Tonga-Hunga-Ha'apai started at 4:14 UTC, threatening to generate a tsunami that can cross the entire Pacific Ocean.

At 4:30 UTC, alarms sounded on the premises of the Pacific Tsunami Warning Center (PTWC) in Hawaii. Detectors monitoring reading of sea-level gauge picked up an anomaly off the coast of Nuku'alofa.

At 4:31 UTC, the Tonga National Tsunami Warning Centre (NTWC) issued a tsunami warning to the local population. At the same time, scientists from the PTWC began data analysis to calculate the arrival time of the waves on all other coastal areas in the Pacific.

The relay system activated among stations all across the Pacific Ocean and the subsequent observations of the parameters of this tsunami started to provide data for estimating the waves' amplitude and arrival time, enabling a wide-system efficient response.

At 06:23 UTC, two hours after the time of the eruption, the PTWC issued its detailed situation analysis to the national crisis centers for the entire Pacific Ocean. The Pacific States then launched their preventive measures: message to the population, mobilization of emergency and security forces, evacuation in sensitive places.

In addition, a total of 12 bulletins were issued from PTWC over a 20-hour time span and tsunami wave measurements were reported from 117 locations.

At 09:01 UTC the wave came in Auckland coast (New Zealand), at 10:31 UTC in Sydney (Australia), at 11:12 UTC in Hawaii (US), at 15:30 UTC at Socorro (Mexico), etc. In some places it was as high as almost 2 meters. It sometimes has penetrated inland for a hundred meters.

The material damage was significant, particularly in Tonga. But the formidable chain of cooperation coordinated by UNESCO, from the international level to the local level, has thus made it possible to protect tens of thousands of people.



Harmful Algal Bloom Programme

Today virtually every coastal country in the world is affected by harmful algal blooms (HABs), microscopic algae or phytoplankton, which can kill marine life and even humans, particularly through the contamination of seafood.

HABs can also have nefarious impacts on water desalination and aquaculture infrastructure, leading to major loss of equipment and disruption of services. Although they

occur naturally, the recent increase in these events is likely to be related to human activities such as the release of sewage effluents and transport of HAB species in ballast water.

The goal of the UNESCO's International Harmful Algal Bloom Programme is to foster and coordinate scientific research into the causes of algal blooms, predict their occurrence and mitigate their impacts.

The programme has helped bolster research, monitoring and management, as well as boosting funding opportunities for scientists, in many countries. UNESCO's role is all the more important when it is difficult for single nations to maintain the necessary funding and support needed to reduce the impact of HABs.

In 2021, UNESCO launched the result of an unprecedented analysis of 9,500 Harmful Algal Bloom (HAB) events worldwide over the past 33 years and found that the harm caused by HABs increases in step with the growth of aquaculture and marine exploitation, signalling the need for more comprehensive, interdisciplinary research.

The analysis created the world's first baseline against which to track future shifts in the location, frequency and impacts of HABs. Such events differ depending on which of the 250 harmful marine algae species is involved and where, requiring assessment on a species-by-species and site-by-site basis.

To conduct this comprehensive study, UNESCO brought together 109 scientists in 35 countries over a period of seven years.

Action Spotlight: Turning the tide on Harmful Algal Blooms in the Seychelles

In October 2015 Clara Belmont was working at the Seychelles Fishing Authority when she first heard news of a possible harmful algal bloom (HAB). Unlike previous smaller blooms this one appeared to cover a much larger area and several reports had been received of dead fish washing up on local beaches.

"The toxicity of the algae had caused fish kills and this stirred up panic. Because of the lack of public knowledge about algal blooms the authorities suddenly found themselves pressured to provide relevant information about the event," she says.

Fortunately Clara had been funded to attend a training course at the UNESCO Science and Communication Centre on Harmful Algae in Copenhagen on how to identify the specific species responsible for different types of toxic blooms.

"Because of the training I received I was able to help collect and analyse water samples of the bloom and we confirmed that it had been caused by the marine dinoflagellate *Cochlodinium polykrikoides*. The responsible authorities carried out necessary procedures to collect samples and send them abroad for further analysis," she says.

Action Spotlight: Supporting Emerging Mariculture in Namibia

At Namibia's Ministry of Fisheries and Marine Resources the Chief Fisheries Biologist, Dr Frikkie Botes, says the UNESCO Harmful Algal Bloom Programme is playing an important role to protect the healthy development of his country's mariculture industry.

He says the capacity development support provided by UNESCO is helping to improve the management of HABs and ensure that Namibia's national water quality monitoring programme meets international

standards. Dr Botes believes the development of a harmonized and integrated seafood safety monitoring programme will enable Namibia's mariculture products to be readily accepted by any international market.

"A number of challenges within our monitoring programme for HABs have proven to be a major stumbling block in efforts by Namibia's mariculture industry to penetrate lucrative international markets," he says.

Dr Botes says the UNESCO support for the delivery of HAB training

courses, and the development of a phytoplankton identification guide for Namibia, means that staff now have the skills needed to accurately identify most phytoplankton species found during regular sampling to monitor water quality.

While this training has helped to boost the confidence of staff members he also believes it will have an even bigger impact on supporting the development of Namibia's emerging mariculture industry and its wider economic development.

Evaluate and Manage

Flagship Ocean Reports

The Global Ocean Science Report 2020 (GOSR2020) is the global reference on Ocean science and offers a global record of the workforce, infrastructures, equipment, funding, investments, publications, blue patents, data flow and exchange policies, as well as national strategies.

The Report provides the critical updated baseline information on existing human and technical capacity so the international community can monitor and assess progress of the Ocean Decade in transforming ocean science.

Action Spotlight: Pursuing gender equality in Ocean Science

Gender equality is far from having been achieved in ocean science but the challenge to reach it is realistic. Female ocean science personnel range from about 7% (Democratic Republic of the Congo) to 72% (Ireland) of all ocean science personnel, including researchers and technical support staff. The global average stands at 37%. The percentage of female ocean science personnel is equal to or higher than 50 in countries such as Angola, Bulgaria, Croatia, El Salvador, Ireland, Poland and Turkey.

Action Spotlight: Less than 2% of Research Budgets Invested in Ocean Science

The availability and allocation of funding for ocean science continues to vary widely between countries and regions, but overall, ocean science funding seems remarkably low when compared to many other fields of research and innovation. On average, only some 1.7% of total gross domestic expenditure on research and development was attributed to ocean science in 2017, with shares ranging from around 0.03% to 11.8% in Peru, the leading country in this respect, followed by South Africa (5.6%), Ireland (5.3%), Norway (4.4%) and Portugal (3.5%).

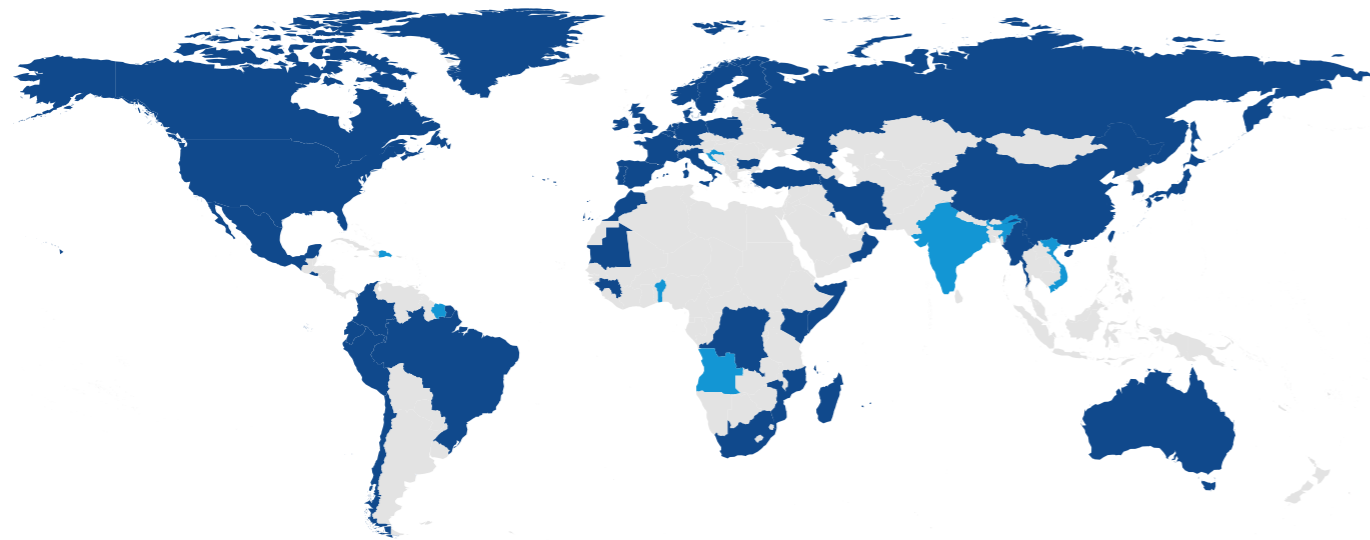
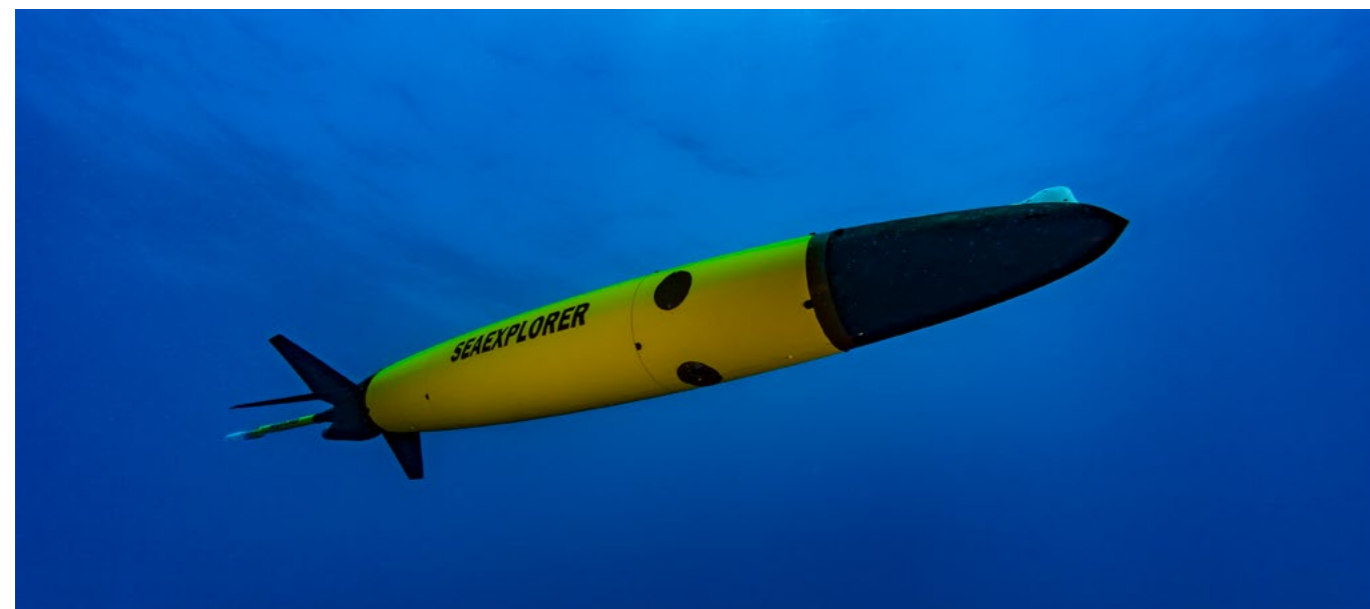
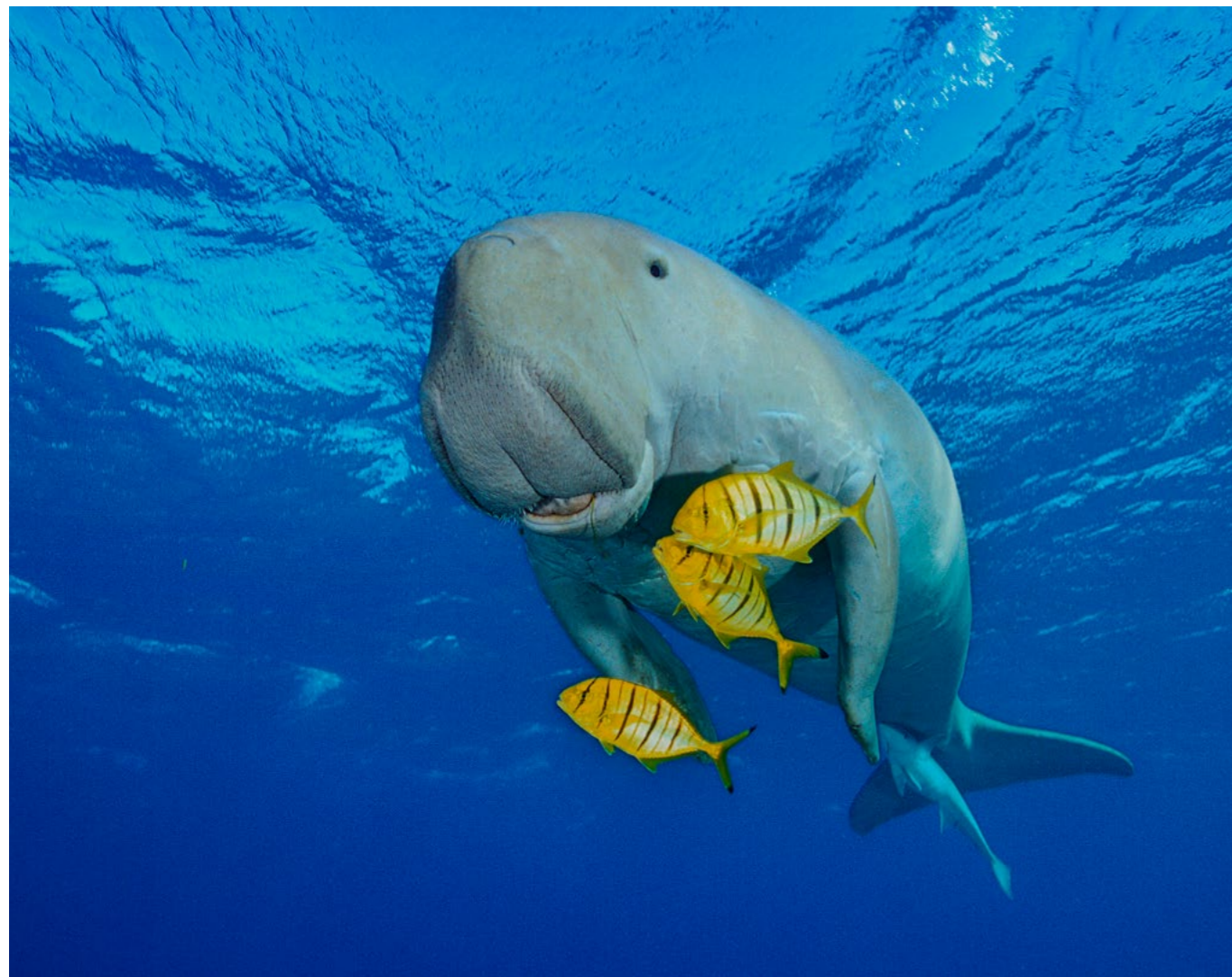


Figure 2.2. Global map indicating the Member States that responded to the questionnaire for GOSR2020 (dark blue); countries whose data from the GOSR2017 are used in the GOSR2020 assessments are shown in light blue.

Source: Based on the GOSR2020 questionnaire.





Managing the ocean and coasts: Marine Spatial Planning

Marine Spatial Planning (MSP), or ‘urban planning for the ocean’, is a practical way to establish a more rational use of marine space and of the many interactions among its uses (transportation, fisheries, energy, etc.), to balance demands for development with the need to protect the environment, and to deliver social and economic outcomes.

UNESCO has been the world’s leading standard-setting agency in Marine Spatial Planning since 2006. In 2017, UNESCO and the European Commission adopted a *Joint Roadmap to accelerate Marine/Maritime Spatial Planning processes worldwide*.

The UNESCO guide “A Step by Step Approach” (2009), and the more recent “MSPglobal: international guide on marine/maritime spatial planning” (2021), published jointly with the European Commission, set out the golden standards used by governments and other stakeholders to harmonize the conceptual approach behind MSP, from establishing authority, through planning to implementation, monitoring and evaluation.

Action Spotlight: Marine Spatial Plans for Abu Dhabi

UNESCO MSP guidance contributed significantly to the development of the Emirate of Abu Dhabi’s coastal and marine framework plan. Abdulla Al Sahi, Executive Director for the Planning and Infrastructure Sector of the Abu Dhabi Urban Planning Council, says the development of its Coastal and Marine Framework Plan, ‘Plan Maritime 2030.’ It seeks to improve the management of the Emirate’s critical marine areas, 2,435km of coastline and some 215 islands. “Much of the success of Abu Dhabi, and indeed the UAE as a whole, is directly linked to its marine areas, therefore ensuring a balanced approach to developing the maritime and coastal areas to enhance economic growth while at the same time protecting these natural assets is vital,” he says.

‘Plan Maritime 2030’ is the first marine spatial plan to be completed and approved within the Gulf Region and the Arab-speaking world. The plan was created to provide guidance to achieve a balance of compatible uses and activities while minimizing conflicts and avoiding impacts on precious natural and cultural resources.



Action Spotlight: Integrated Coastal Zone Management in the Southeast Pacific

The five countries of Chile, Colombia, Ecuador, Panama and Peru share a coastline that stretches over more than 8,000 km along the southeast coast of the Pacific. This extensive zone contains a great diversity of ecosystems such as mangroves, coral reefs and upwelling areas. Because of the rapid development of this region these countries need to find effective ways to protect coastal ecosystems while also supporting sustainable socio-economic growth.

The Southeast Pacific Data and Information Network in Support of Integrated Coastal Zone Management (SPINCAM) Project supported these countries in developing a science-based strategy for the sustainable development of their coastal areas. It was funded by the Flemish Government of the Kingdom of Belgium.

SPINCAM’s established an integrated coastal management indicator framework helping to map the state of the coastal and marine

environment and related socio-economic conditions so that communities and governments have the information they need to improve the sustainable management of coastal and marine areas. Each country has now agreed to measure and work on a set of regional indicators using the same units and formats that allow direct comparison of progress in coastal management, protection of migratory species, and reduction of marine pollution at the regional level.

Educate, Enable

Ocean Teacher Global Academy

IOC-UNESCO's OceanTeacher Global Academy (OTGA) is a global network of Regional and Specialized Training Centres delivering training on ocean sciences, services and marine and information data management (including marine biodiversity data and ocean best practices). The comprehensive web-based *OceanTeacher e-Learning Platform* supports classroom training (face-to-face), blended training (combining classroom and distance learning), and online (distance) learning.

Ocean Teacher provides an end-to-end training system for ocean data managers, marine information managers and marine researchers who wish to learn how to manage or use oceanographic data and information. The training platform uses advanced information technology and multilingual training resources to deliver courses in a range of topics from Integrated Coastal Management to Tsunami Warning Systems.

Action Spotlight: Fit-For-Purpose Training for Small Island Developing States

One of the priorities for the OceanTeacher Project is to develop the capacities of researchers and ocean practitioners from Small Island Developing States (SIDS), enabling them to contribute to the conservation and sustainable management of the ocean. OceanTeacher offers courses and training modules especially aligned with the objectives of the SIDS Accelerated Modalities of Action (SAMOA) Pathway, an international framework aimed at addressing the priorities of the highly vulnerable SIDS, including the impacts of climate change and accelerating sustainable development. OceanTeacher

supports the "Oceans and Seas" Priority Area of the SAMOA Pathway through the implementation of capacity development with special reference to the training requirements of SIDS.

'Plan Maritime 2030' is the first marine spatial plan to be completed and approved within the Gulf Region and the Arab-speaking world. The plan was created to provide guidance to achieve a balance of compatible uses and activities while minimizing conflicts and avoiding impacts on precious natural and cultural resources.

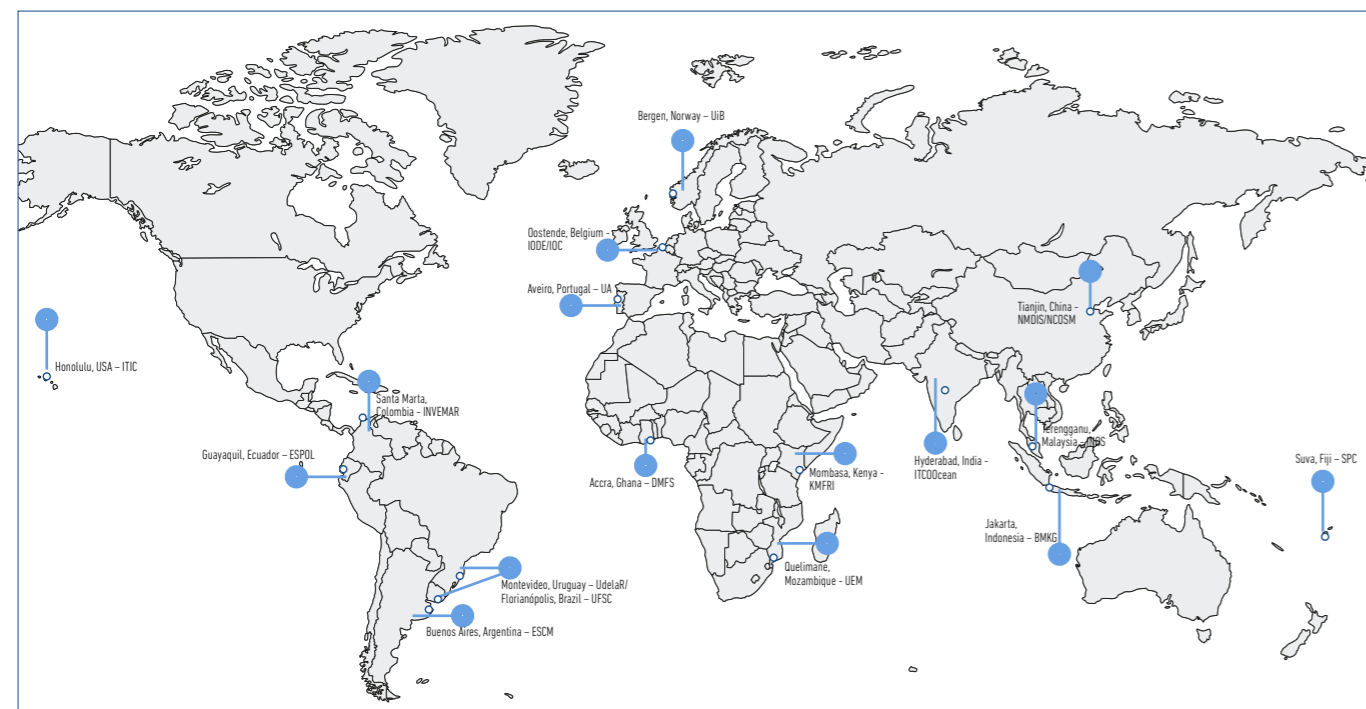


Figure 4.29. Location of OTGA regional training centres and specialized training centres (November 2020). Source: IODE.

Ocean Literacy

Ocean literacy is defined as "an understanding of the ocean's influence on you and your influence on the ocean". UNESCO is working to support ocean research institutions around the world to strengthen public engagement and build greater ocean literacy so we can all have a greater understanding of what we can do to protect the health of our ocean.

UNESCO *Ocean Literacy Portal* (<https://oceanliteracy.unesco.org/>) serves as a worldwide one-stop shop, providing resources and content to all, with the goal of creating an ocean-literate society able to make informed and responsible decisions on ocean resources and ocean sustainability.

UNESCO is also working with its Member States to include ocean education in school curricula. A new toolkit for public leaders will be launched for this purpose in the first half of 2022.

Action Spotlight: Mainstreaming Ocean Awareness in Schools across 10 countries

A collaboration between the Prada Group and UNESCO, the SeaBeyond Project is an educational programme for secondary schools to raise awareness on ocean sustainability. Over 300 students from ten countries participated in the first cycle of the Project, a competition among ocean awareness-raising campaigns developed by students for their peers.

Through a digital award ceremony, Prada and UNESCO announced the winning entry, a short cartoon, *Redes circulares: Cerco ao plástico no mar* ("Circular nets: a sea of plastic"), showing the catastrophic plastic pollution that endangers the ocean ecosystems and how to collect plastic waste for recycling. It was developed by the Portuguese school *Agrupamento de Escolas de Vialonga* in Vialonga (Lisbon).

The second-place was won by Shanghai High School International Division (China), with a board game, *Environopoly*, that aims to provide both entertainment and environmental knowledge to students. It was followed by *Colegio Latino, Villahermosa, Tabasco* (Mexico), with the awareness campaign titled "Sea Beyond", dedicated to the impact of microplastics' on the ocean.

Prada awarded €5,000 to the winning school to be invested in environmental educational materials, and the three leading campaigns were disseminated on Prada and UNESCO social channels.





Protect, Transmit

50 UNESCO World Heritage Marine Sites

Since the inscription of the first marine site on UNESCO's World Heritage List in 1981, the Organization's World Heritage Marine Programme has grown into a global collection of unique ocean places stretching from the tropics to the poles. Today, the List number 50 unique ocean places across 37 countries recognized for their unique marine biodiversity, singular ecosystems, unique geological processes and incomparable beauty.

The programme brings together and stimulates open science research efforts, notably to prepare for the impact of climate change of marine World Heritage sites, 70% of which are already under threatened by global warming, while 75% of them are unprepared to tackle the climate challenges ahead.

In 2021, UNESCO published the first global scientific assessment of its World Heritage marine sites' blue carbon ecosystems, highlighting the critical environmental value of these habitats which in 2018 stored the equivalent to about 10% of the world's annual greenhouse gas emissions keeping billions of tons of CO2 and other greenhouse gases out of the atmosphere. While Marine World Heritage sites represent less than 1% of the world's ocean, they host at least 21% of its blue carbon ecosystem area, and 15% of the world's blue carbon assets.

The study quantifies the carbon value of these sites and recommending specific blue carbon strategies to conserve them, warning that unless they are preserved, they could release the vast carbon stocks they hold into the atmosphere, contributing to global warming instead of mitigating it. UNESCO's research findings point the way for countries, regions, and local communities seeking to conserve these areas and pursue blue carbon strategies.

Resilient Reef Initiative

UNESCO's Reef Resilience Initiative seeks to protect critically important coral reefs which occupying less than 1% of the ocean floor but support 25% of all marine life and the livelihoods and wellbeing of almost one billion people across 101 countries. It is estimated that 75% of these formations are currently under threat from local stresses and climate change.

Resilient Reefs is piloting this work with five World Heritage sites around the world: Belize Barrier Reef, Belize; Great Barrier Reef, Australia; Lagoons of New Caledonia, France; Ningaloo Coast, Australia; and Rock Island South Lagoon, Palau.

The initiative includes the appointment of Resilience Officers at each site, supporting resilience strategies, training for site managers and stakeholders, the creation of a global knowledge network brining together reef site managers and world experts, seed funding for actions identified in the resilience strategy through a dedicated Implementation Fund.



© UNESCO

Biosphere Reserves

UNESCO's Man and the Biosphere (MAB) Programme, a pioneering sustainability initiative established almost 50 years ago, connects a vast global network of Biosphere Reserves that share best sustainable terrestrial and marine development practices. The network includes 232 marine biosphere zones and a total marine area more than 210,000 km.

Since 2012, the MAB Programme has included a World Network of Island and Coastal Biosphere Reserves (WNICBR), specifically dedicated to the study, implementation and dissemination of island and coastal strategies to preserve biodiversity and heritage, promote sustainable development, adapt to and mitigate the effects of climate change.

The network brings together representatives of 20 islands and coastal biosphere reserves from around the world and is open to all islands and coastal biosphere reserves that want to join it. Notable initiatives by WNICBR include a Zero Plastic campaign to combat the impacts of plastic pollution, which is particularly damaging to the ocean and marine life.

Geoparks

UNESCO also protect marine areas, notably islands and coastal environments, through its Global Geoparks Network which includes over 40 sites with marine components.

UNESCO's Global Geoparks (UGG) are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development.

Notable marine protection initiatives conducted by the Geoparks include a successful dune restoration programme in the Basque Coast UGG in Spain. Using and supporting natural processes, notably through the extensive planting of local plants behind beaches, the regeneration of largely destroyed sand dunes was well underway after just a few years at a very low financial cost.

The dunes formed on the western coast of Gipuzkoa Province thanks to this initiative are contributing to the restoration of plant and animal diversity while offering a natural protection to coastal areas from rising sea levels, and mitigating the effect of storms at sea. Similar projects have been implemented in other Geoparks, notably at the Burren and Cliffs of Moher UGG (Ireland). The Ciletuh –Palabuhanratu UGG of Indonesia, situated on the island of Java, contains important sea turtle nesting grounds, one of the largest for the Green Turtle in South Asia. It has been able to improve the protection of the species in collaboration with the Ujung Genteng Turtle Conservation Centre.







Photography

The Ocean Image Bank: Collection of thousands of stunning and powerful ocean images by award-winning photographers made freely available to support UNESCO's flagship initiative, the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) - the 'Ocean Decade' (<https://www.theoceanagency.org/ocean-image-bank>)

One Ocean Project: Through the lenses of photographer Alexis Rosenfeld, the project brings together a mass of high-quality and never seen before images showcasing the uniqueness of our one ocean and the crucial importance of its preservation to the survival of humanity (<https://1ocean.blue/>)

Videography

Ocean Decade Introduction (Animated)

1-minute explainer of the UN Decade of Ocean Science for Sustainable Development 2021-2030
https://drive.google.com/drive/folders/1ZVX-yBYcngN-jCuiF_b1De9wklFkVw-T?usp=sharing

Ocean Decade 2021-2030: A Global Perspective

The Ocean Decade presented through the perspective of experts from all over the globe:
<https://drive.google.com/file/d/11N-0wY2ykpJ3Owibkbbk-k2tiyNOCH0ohI/view?usp=sharing>

Ocean Decade Challenges (Animated)

An introduction to the 10 most immediate and pressing needs of the Decade, from sustainably feeding the planet to addressing climate change:
https://drive.google.com/drive/folders/1LR-w8O-86b4h11ZeW_GbZ4zD4OiBHVGlj?usp=sharing

Global Ocean Science Report

A global record of how, where and by whom ocean science is conducted:
<https://drive.google.com/file/d/1lfZpce-OSiEkoTjrRgu8qvs0jLKJZ2oF/view?usp=sharing>

Ocean Literacy Principles

Seven crucial things anyone should know about the ocean and our interconnection:
<https://drive.google.com/drive/folders/1DQGDxVcZN-Qimawf3KhICl3f3X5qaBeMD?usp=sharing>

All images by Alexis Rosenfeld, 1 Ocean, the anatomy in partnership with UNESCO, 10 years program to explore, document and sensitize the world on ocean sustainability.

 [@alexis.rosenfeld](https://www.instagram.com/alexis.rosenfeld)





unesco

Intergovernmental
Oceanographic
Commission



2021 United Nations Decade
2030 of Ocean Science
for Sustainable Development



UNESCO is the UN agency in charge of ocean research.

The Intergovernmental Oceanographic Commission (IOC) of UNESCO, founded in 1960 and joined by 150 countries, coordinates global programs such as ocean mapping and tsunami alert system, as well as numerous scientific research projects.

The agency is also the guardian of unique ocean places, through marine biosphere reserves and marine World Heritage sites

English Press Enquiries:

Clare O'Hagan • +44 7715 99 12 79 • +33 (0) 1 45 68 17 29 • c.o-hagan@unesco.org

French Press Enquiries:

Thomas Mallard • +33(0) 1 45 68 22 93 • t.mallard@unesco.org