



**United Nations**

Department of  
Economic and  
Social Affairs



# Mapping Report on Existing Ocean Databases in Support of SDG 14



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## **Note**

This report was prepared by Professor YU Rencheng, Marine Biologist of Institute of Oceanology, Chinese Academy of Sciences, and Consultant for the Division for Sustainable Development Goals, United Nations Department of Economic and Social Affairs. The views expressed in this report are those of the author and do not necessarily reflect those of the United Nations.

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## Summary

The ocean is the largest ecosystem on our planet, providing a range of resources necessary for sustainable development. In 2015, the UN General Assembly endorsed the 2030 Agenda, putting forward 17 Sustainable Development Goals (SDGs) and 169 targets, the achievement of which is to be measured by proposed indicators.

Oceans, seas and marine resources are at the centre of SDG14 “Life below water”, the multifaceted nature of which requires a shared information and knowledge system in order to support its implementation.

In recognition of the need to access the data and information related to different aspects of the ocean, this report aims to map existing ocean databases related to each target of SDG 14. The databases are introduced, and information on how to access them is offered. Finally, the gaps in data access, collection, and dissemination are analyzed and policy advice is provided.

For each Target of SDG 14, related databanks/datasets and methodologies are introduced. Multiple datasets stored and organized in a single data portal are considered as a databank, and the data on specific topics are introduced as datasets. For some SDG targets, methodologies on how to analyze data are also introduced.

The purpose of this handbook is to assist developing countries in increasing access to reliable data, and to enhance capacity of data-supported decision-making on conservation and sustainable use of oceans, seas and marine resources. Ocean data, however, cover a wide range of aspects. With increasing capabilities in observation, huge amounts of data have been collected and accumulated in such a wide variety of organizations, that it's almost impossible to summarize all the related datasets. Therefore, in this report, only the datasets closely related to each target of SDG 14 are briefly introduced.

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The report was prepared by Dr. Rencheng Yu, assisted by Dr. Huixia Geng, Dr. Zhengxi Zhou, and Dr. Yifan Li. The co-authors appreciate the assistance of graduate students from the Institute of Oceanology, Chinese Academy of Sciences.

## **I. Introduction to SDG14 and ocean data**

The ocean is the largest ecosystem on our planet that provides a range of important goods and services, including the provision of food and energy resources, habitat for biodiversity, climate regulation and carbon sequestration, recreation and tourism, water quality, etc. Over 40% of the global population lives within 200 km of the ocean. Rapid development has increased pressures on the ocean, causing a degradation of ecosystem services. The interconnectedness between the ocean, human livelihood and health led to the formulation of the SDG 14 of the 2030 Agenda for Sustainable Development by the United Nations (Visbeck et al., 2014; United Nations General Assembly, 2015). SDG14 “Life below water” pays specific attention to the importance of oceans and waterways, recognizing the close connection between the ocean and human well-being. To support SDG 14, the UN announced a Decade of Ocean Science for Sustainable Development (2021–2030), seeking to mobilize the scientific community, policymakers, business, and civil society around a program of joint research and technological innovation (Ryabinin et al., 2019).

The 2030 Agenda for Sustainable Development encourages Member States to conduct regular reviews of progress (Lucks et al., 2019). To help track progress towards achieving the Goals, the Open Working Group identified targets for key aspects of each of them. In addition, a global indicator framework was adopted by the UN General Assembly on 6 July 2017. The latter will be further refined and reviewed. SDG 14 has ten targets, aiming to “conserve and sustainably use the oceans, seas and marine resources for sustainable development”. These targets range from marine debris and pollution, environmental management and restoration, ocean acidification, biologically sustainable fisheries,

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conservation areas, fisheries subsidies, sustainable economic benefits, ocean-related research, small-scale fisheries, and legal frameworks. Most of the corresponding indicators for these targets, however, are classified as Tier 3, with “no internationally established methodology or standards yet available for the indicator”, making it difficult to evaluate progress towards SDG 14.

The SDG 14 targets are broad in scope and interconnected. To measure progress and/or achievement, data relating to each target of SDG 14 are critically needed. However, there are many challenges concerning effective data collection and analysis. In the field of ocean science, data are mainly collected through sample analyses and observations, which are diverse in type and coverage. The rapid increase in the number and variety of ocean-observing systems and other new data sources is dramatically changing the ability to monitor and understand the ocean. *In situ* ocean observations are crucial sources of data for understanding the ocean system and assessing the impacts of management strategies. The observations have different coverage, from the global ocean (e.g. the Array for Real-time Geostrophic Oceanography (ARGO), OceanSITES, OceanGLIDERS, the Global Surface Drifter Array (GSDA), the Global Tropical Moored Buoy Array (GT MBA), the Global Ocean Ship-Based Hydrographic Investigation Program (GO-SHIP), the voluntary observing ship program (VOS), basin-scale (e.g., the Integrated Atlantic Ocean Observing Systems (AtlantOS), the Tropical Pacific Observing System, the Indian Ocean Observing System, Tropical Atlantic Observing System, Arctic Ocean and Southern Ocean observing systems), regional scale (e.g., for boundary currents and inter-ocean exchanges), to various coastal observing systems. Satellite observations offer near-global coverage at useful spatial and temporal resolution suited for estimating the state of the ocean system. Among many data centers and providers, the Earth Observing System (EOS) built by the National Aeronautics and Space Administration (NASA) and the European Remote Sensing (ERS) satellite system by the European Space Agency (ESA) are commonly used. Additionally, a series of field campaigns, such as the World Ocean Circulation Experiment (WOCE),

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Salinity Processes in the upper-Ocean Regional Study (SPURS), and the Joint Global Ocean Flux Study (JGOFS), were performed to provide ocean observations of unprecedented extent and quality.

Ocean data are managed by a variety of systems. In the case of the Global Ocean Observation System (GOOS), for example, data are managed by means of regional observing system nodes, space agency satellite data centers, the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) panels, integrated data assembly centers (DACs), designated International Oceanographic Data and Information Exchange (IODE) /International Council for Science (ICSU) World Data Centers (WDCs), and some research field campaigns (Snowden et al., 2019). The Integrated DACs operate at either the national or regional scale. DACs, such as the Group for High Resolution Sea Surface Temperature (GHRSSST), Surface Ocean CO<sub>2</sub> Atlas (SOCAT), the World Ocean Database (WOD), and the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), provide professional datasets of high quality. WDCs acquire, catalogue, and archive data, publications, and data inventory forms, making them available to the international community, which facilitates international exchange of ocean data. The information systems, also known as “data portals”, “data directories” or “clearinghouses”, are used to search for and harvest data from various archives and repositories, packaging them in collections of data/products.

In this report, databases related to each target of SDG 14 are mapped and analyzed in the context of their support to the implementation of SDG 14.

Source	Abbreviation	Full Name	Website
Global observing system nodes	ARGO	Array for Real-time Geostrophic Oceanography	<a href="https://argo.ucsd.edu/">https://argo.ucsd.edu/</a>
	GT MBA	Global Tropical Moored Buoy Array	<a href="https://globalocean.noaa.gov/Research/Global-Tropical-Moored-Buoy-Array">https://globalocean.noaa.gov/Research/Global-Tropical-Moored-Buoy-Array</a>
	IOCCP	International Ocean Carbon Coordination Project	<a href="https://www.ioccp.org/">https://www.ioccp.org/</a>
	OceanSITES	OceanSITES	<a href="http://www.oceansites.org/">http://www.oceansites.org/</a>
	GLOSS	Global Sea Level Observing System	<a href="https://gloss-sealevel.org/">https://gloss-sealevel.org/</a>
	OceanGLIDERS	OceanGLIDERS	<a href="https://www.oceanglid.org/">https://www.oceanglid.org/</a>
	VOS	Voluntary Observing Ship Program	<a href="https://www.vos.noaa.gov/">https://www.vos.noaa.gov/</a>
	TMBS	Tropical Moored Buoy System	<a href="https://climatedataguide.ucar.edu/climate-data/tropical-moored-buoy-system-tao-triton-pirata-rama-toga">https://climatedataguide.ucar.edu/climate-data/tropical-moored-buoy-system-tao-triton-pirata-rama-toga</a>
Satellite data centers	ESA	European Space Agency	<a href="https://www.esa.int/">https://www.esa.int/</a>
	EOS	NASA's Earth Observing System	<a href="https://eosps.nasa.gov/content/nasas-earth-observing-system-project-science-office">https://eosps.nasa.gov/content/nasas-earth-observing-system-project-science-office</a>
	NESDIS	National Environmental Satellite Data and Information Service	<a href="https://www.nesdis.noaa.gov/">https://www.nesdis.noaa.gov/</a>
	NSOAS	National Satellite Ocean Application Service	<a href="http://www.nsoas.org.cn/eng/">http://www.nsoas.org.cn/eng/</a>
Integrated DACs	GHR SST	Group for High Resolution Sea Surface Temperature	<a href="https://www.ghrsst.org/">https://www.ghrsst.org/</a>
	SOCAT	Surface Ocean CO <sub>2</sub> Atlas	<a href="https://www.socat.info/">https://www.socat.info/</a>

	WOD	World Ocean Database	<a href="https://www.ncei.noaa.gov/products/world-ocean-database">https://www.ncei.noaa.gov/products/world-ocean-database</a>
	ICOADS	International Comprehensive Ocean-Atmosphere Data Set	<a href="https://icoads.noaa.gov/">https://icoads.noaa.gov/</a>
WDCs	WDS-Oceanography	World Data Service for Oceanography	<a href="https://www.nodc.noaa.gov/worlddatacenter/">https://www.nodc.noaa.gov/worlddatacenter/</a>
	WDC-Meteorology	World Data Center for Meteorology	<a href="https://www.ncdc.noaa.gov/wdcmnet">https://www.ncdc.noaa.gov/wdcmnet</a>
Field campaigns	WOCE	World Ocean Circulation Experiment	<a href="https://www.ewoce.org/">https://www.ewoce.org/</a>
	SPURS	Salinity Processes in the upper-Ocean Regional Study	<a href="https://salinity.oceansciences.org/science-spurs.htm">https://salinity.oceansciences.org/science-spurs.htm</a>
	JGOFS	Joint Global Ocean Flux Study	<a href="http://ijgofs.whoi.edu/">http://ijgofs.whoi.edu/</a>



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## II. Mapping of databases related to SDG 14 targets

### Target 14.1 Prevent and significantly reduce marine debris and pollution

**Target 14.1** Prevent and significantly reduce marine pollution and debris

**Indicator 14.1.1** Index of coastal eutrophication and floating plastic debris density

**Status of indicator:** UN Environment Programme (UNEP) has produced a global manual of proxy indicators, developed in line with regional seas core indicators

Custodian agency: UNEP

Partner agency: IOC-UNESCO, the International Meteorological Organization (IMO) and the Food and Agriculture Organization of the United Nations (FAO).

Marine pollution is the result of deliberate or accidental discharge of untreated wastewater, including the dumping of solid wastes and other polluted runoff from a variety of land-based activities directly into rivers and coastal waters (Haeder et al., 2020; Thushari et al., 2020). About 40% of the ocean is affected by pollution, mainly from land-based activities (Xu et al., 2020). Marine pollution is often a transboundary issue that affects areas far from the source of pollutants.

#### 1. Databanks

##### 1) ***EMODnet Chemistry*** (<https://www.emodnet-chemistry.eu/>)

The European Marine Observation and Data Network (EMODnet) is a network of organizations supported by the EU's integrated maritime policy. These organizations work together to observe the sea, process data according to international standards and make that information available as interoperable data layers and products. EMODnet Chemistry provides detailed data on the concentration of nutrients, organic matter, pesticides, heavy metals, radionuclides and antifoulants in water, sediment and biota. It gives free and open

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access to data on eutrophication in seawater from all EU basins. More than 600,000 datasets and CDI metadata concerning eutrophication are currently stored in the EMODnet Chemistry portal. The data sets are managed by tens of data centres and a robot harvesting system which allows the automatic retrieval of information from connected data centres with a configured query filter. Visualization products are available through the Map Viewer. Validated data collections have been used as input for preparing spatially interpolated concentration maps, with Data-Interpolating Variation Analysis (DIVA) software. These products consist of gridded climatologies that display the depth-time variability of the concentration of different variables: dissolved inorganic nitrogen, phosphate, silicate, chlorophyll-*a*, and dissolved oxygen concentration. Horizontal sections of the 4-dimensional fields (longitude, latitude, depth, and time) can be visualized at a selected depth and time. The climatological fields can also be interpolated and visualized on arbitrary vertical sections.



[EMODnet Chemistry portal](#)

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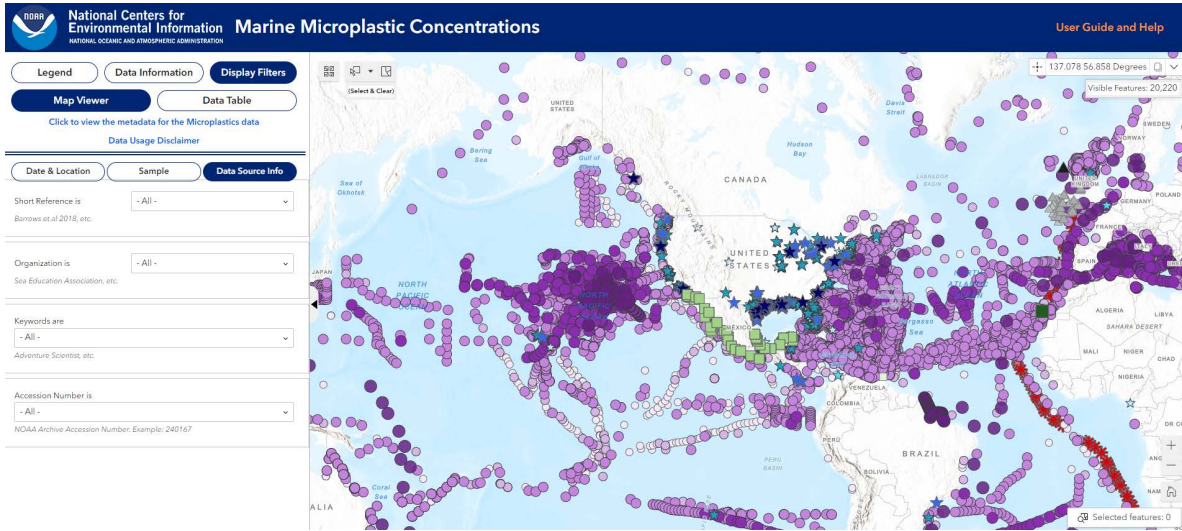
EMODnet is a long-term initiative launched in 2009 by the EU Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE). It is part of the Blue Growth strategy, Marine Knowledge 2020, and its main task is to ensure that European marine data will become easily accessible, interoperable, and free of restrictions on use. The "collect once and use many times" philosophy benefits marine data users, including policymakers, scientists, private industry, and the public.

## **2) NCEI Marine Microplastics Product Database**

(<https://www.ncei.noaa.gov/products/microplastics>)

The National Oceanic and Atmospheric Administration (NOAA)'s National Centers for Environmental Information (NCEI) hosts and provides public access to one of the most significant archives for environmental data. NCEI provides over 37 petabytes of comprehensive atmospheric, coastal, oceanic, and geophysical data, which help businesses and organizations across sectors operate more efficiently, safely, economically, and environment friendly.

The NCEI Marine Microplastics product provides access to aggregated global data on microplastics in marine settings. The product gives researchers and others access to information on ocean currents, enabling a unified understanding of the global microplastic problem. The information is used to improve water quality and protect Earth's ecosystem. This product can also be used to validate remote sensing technologies that identify and characterize microplastics from space. Data in the NCEI Marine Microplastics product database were collected from Adventure Scientists Microplastics initiative surveys of microplastics pollution in aquatic ecosystems between 2013 and 2017, the Sea Education Association (SEA) Plastics Project in 2010, and SEA Plastics Project undertaken in 2017 and 2018. The concentrations of marine microplastics are provided in the database, which allows users to view data online or download the original data in CSV, NetCDF, and ArcGIS formats. The online map offers data filters by data source and date.

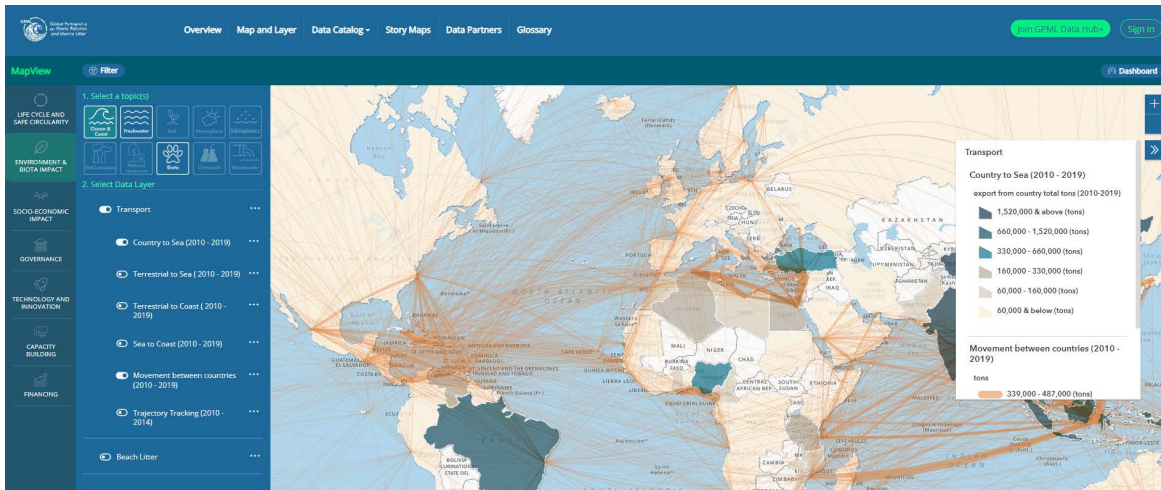


The NCEI Marine Microplastics product

**3) Global Partnership on Marine Litter Digital Platform** (<https://digital.gpmarinelitter.org/>)

The Global Partnership on Marine Litter (GPML) Digital Platform was set up in 2020 to guide action towards the long-term elimination of marine litter and plastic pollution. This open-source platform compiles and integrates data from different resources and connects multiple stakeholders. The website of the GPML data hub provides online visualization of ocean eutrophication, marine debris and microplastics, marine litter hotspots, and much more other data concerning marine pollution. The GPML data hub also offers links to other marine databases and datasets of ocean eutrophication, pollution and microplastics.

The Digital Platform is a UNEP contribution to the GPML. UNEP supports Member States, ensuring that environmental sustainability is reflected in development and investment planning, and provides countries with the necessary tools and technologies to protect and restore the environment.



## The Global Partnership on Marine Litter (GPML) Digital Platform

### 2. Datasets

#### 1) **Monit-Seawater, Monit-Biota, and Monit-Sed** (<https://www.4demon.be/>)

The monitoring data on hydrography, water quality and contaminants for the Belgian continental shelf area and Western Scheldt records data from 1977 and is still a work in progress. It monitors such parameters as ammonium, atmospheric humidity, cadmium, copper, DDT (+DDD, DDE), hexachlorobenzene, hexachlorocyclohexane compounds (HCH), lead, mercury, metals, nitrate, nitrite, phosphate, salinity, Secchi depth, silicate, sum of 7 PCBs, temperature in water, total suspended matter, wind direction and speed, and zinc, among others. The dataset focuses on the environmental condition of sea areas of Belgium and the Netherlands. It is managed by Beheerseenheid Mathematisch Model Noordzee en Schelde-estuarium and Belgisch Marien Datacentrum (BMDC).

#### 2) **Data for UK OSPAR Common Procedure - Eutrophication Assessment**

(<https://data.cefas.co.uk/view/19289>)

The dataset includes parameters of chlorophyll (by fluorometry), dissolved oxygen, salinity, temperature, and nutrients (including nitrate, nitrite, total oxidized nitrogen, ammonium, phosphate, and silicate) from 1999 to 2014 in the sea area around the United Kingdom. The dataset is provided by the Centre for Environment, Fisheries and Agriculture

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Science (Cefas).

3) **HELCOM PLC Database** (<https://helcom.fi/>)

The dataset contains waterborne nutrients and contaminants from the Helsinki Commission (HELCOM) pollution load monitoring. Compilations of pollution load data (PLC) have been an integral part of the HELCOM assessment system since 1987, focusing on annual and periodic assessments of nutrient inputs and selected hazardous substances. The database is currently managed by the Baltic Marine Environment Protection Commission.

4) **CLiP South Africa Microplastics in Biota 2019** (<https://data.cefas.co.uk/view/20476>)

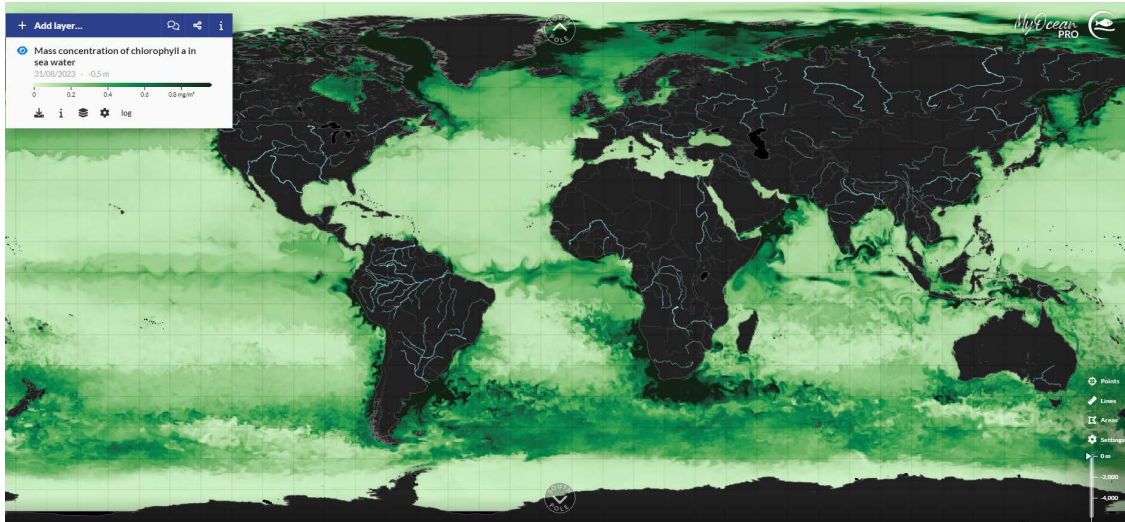
The dataset reports microplastic abundance in biota samples (anchovies, red-eye round herring, and sardines) collected and analyzed in South Africa in 2019. The dataset is provided by Cefas.

5) **Global Ocean Biogeochemistry Analysis and Forecast from Copernicus**

([https://resources.marine.copernicus.eu/product-detail/GLOBAL\\_ANALYSIS\\_FORECAST\\_BIO\\_001\\_028/INFORMATION](https://resources.marine.copernicus.eu/product-detail/GLOBAL_ANALYSIS_FORECAST_BIO_001_028/INFORMATION))

The operational Mercator Ocean Biogeochemical Global Ocean Analysis and Forecast System provides 10 days of 3D global ocean forecasts updated weekly. The time series is aggregated in time, in order to reach a two full years' time series sliding window. This product includes daily and monthly mean files of biogeochemical parameters (chlorophyll, nitrate, phosphate, silicate, dissolved oxygen, dissolved iron, primary production, phytoplankton, pH, and surface partial pressure of carbon dioxide) over the global ocean. The global ocean output files are displayed with a 0.25-degree horizontal resolution with regular longitude/latitude equirectangular projection. There are 50 vertical levels, ranging from 0 to 5,700 meters, within the system. The data is managed by the European Commission.





The Mercator Ocean Biogeochemical Global Ocean Analysis and Forecast System

**6) Global Ocean Biogeochemistry Hindcast from Copernicus**

([https://resources.marine.copernicus.eu/product-detail/GLOBAL\\_ANALYSIS\\_FORECAST\\_BIO\\_001\\_028/INFORMATION](https://resources.marine.copernicus.eu/product-detail/GLOBAL_ANALYSIS_FORECAST_BIO_001_028/INFORMATION))

The biogeochemical hindcast for global ocean is produced at Mercator-Ocean (Toulouse, France). It provides 3D biogeochemical fields for the time period 1993-2019 at 0.25 degree and on 75 vertical levels. It uses Pelagic Interactions Scheme for Carbon and Ecosystem Studies (PISCES) biogeochemical model. There is no data assimilation in this product. The data is operated by the European Commission.

**3. Methodologies**

**1) Large Marine Ecosystems: Status and Trends** (<http://www.geftwap.org/publications/lmes-technical-report>)

This handbook explains how the Index of Coastal Eutrophication (ICEP), floating plastic debris, pollution status of persistent organic pollutants (DDTs, HCHs, etc.), and nutrient inputs from river systems to coastal waters are calculated in the GEF-TWAP Large Marine Ecosystem Assessment.

**2) Eutrophication Monitoring Guidelines by Remote Sensing for the Northwest Pacific Action Plan (NOWPAP) Region** (<https://wedocs.unep.org/handle/20.500.11822/26167>)

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These guidelines have been designed particularly for coastal managers in local government and professional researchers. It involves tools that are useful for translating satellite remote sensing data into information and eutrophication monitoring. It is hoped that these guidelines will contribute to the proper use of satellite data for monitoring and assessment of eutrophication, and as a result, to capacity building for the NOWPAP members.

**3) Procedures for Assessment of Eutrophication Status Including Evaluation of Land-based Sources of Nutrients for the NOWPAP Region**

([https://wedocs.unep.org/bitstream/handle/20.500.11822/26260/Eutrophication\\_Procedure.pdf?sequence=1&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/26260/Eutrophication_Procedure.pdf?sequence=1&isAllowed=y))

The objective of these Procedures is to enable NOWPAP member states to assess the status and impacts of eutrophication in their respective sea areas by using information obtained through existing monitoring activities. The assessment results can be utilized by each NOWPAP member state for consideration and development of monitoring systems and countermeasures against eutrophication. The content of the Procedures will be continuously revised and improved reflecting the feedback from member states.

**4) Sampling and Analysis Techniques for the Eutrophication Monitoring Strategy of MED POL**

(<https://wedocs.unep.org/bitstream/handle/20.500.11822/513/mts163.pdf?sequence=2&isAllowed=y>)

Within the Regional Seas Programme of UNEP, many scientists are concerned about eutrophication problems and there is an increasing demand for the reliable analysis of both nutrients and phytoplankton pigments in seawater as well as phytoplankton determinations. This manual is designed to support the Short-term Eutrophication Monitoring Strategy (UNEP (DEC)/MED WG.231/14, 2003) of MED POL (UNEP/MAP) for the Mediterranean Sea. According to the short-term monitoring strategy, some physical (temperature, pH, salinity, transparency, dissolved oxygen: saturated and measured), chemical (orthophosphate, total phosphorus, ammonium, nitrite, nitrate and silicate) and



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biological (chlorophyll-*a*, phytoplankton abundance and bloom dominance) variables are considered as mandatory monitoring parameters.

**5) Assessment for Estuarine Trophic Status (ASSETS) Model** (<http://www.eutro.org/>)

The National Estuarine Eutrophication Assessment/ASSESSment of Estuarine Trophic Status (NEEA/ASSETS) is a screening model that uses a Pressure-State-Response framework to assess eutrophication. Reliability of the assessment is determined in an initial data evaluation stage where the completeness and reliability of the data is determined based on spatial and temporal sampling scales. Analytical methodology is also taken into account. The eutrophication assessment rating for an estuary will be one of five categories: high, good, moderate, poor, or bad. These categories are color-coded following the convention of the EU Water Framework Directive (2000/60/EC) and provide a scale for setting eutrophication-related reference conditions for different types of transitional waters.

**6) HELCOM Guidelines for the Annual and Periodical Compilation and Reporting of Waterborne Pollution Inputs to the Baltic Sea (PLC-Water)**

(<https://helcom.fi/media/publications/PLC-Water-Guidelines-2019.pdf>)

The guideline handbook reports the annual and periodical compilation and reporting of waterborne pollution inputs to the Baltic Sea by HELCOM. The report includes sampling strategies and evaluation methods on estimating inland nutrient input towards the sea.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
<i>Target 14.1 Prevent and significantly reduce marine pollution and debris</i>	<b>Index of coastal eutrophication and floating plastic debris density</b>	UN Environment Programme	Databanks	EMODnet Chemistry	European Union (EU)	EMODnet Chemistry provides detailed data on nutrients, organic matter, pesticides, heavy metals, radionuclides and antifoulants in water, sediment and biota.
				NCEI Marine Microplastics product database	NOAA's National Centers for Environmental Information (NCEI)	The NCEI Marine Microplastics product provides access to aggregated global data on microplastics in marine settings.
				Global Partnership on Marine Litter Digital Platform	Global Partnership on Marine Litter (GPML)	The website of GPML data hub provides online visualization of ocean eutrophication, marine debris and microplastics, marine litter hotspots, and much more other data concerning marine pollution.
			Datasets	Monit-Seawater, Monit-Biota, and Monit-Sed	Beheerseenheid Mathematisch Model Noordzee en Schelde-estuarium; Belgisch Marien Data Centrum (BMDC)	The datasets focus on the environmental condition of sea areas of Belgium and the Netherlands.
				Data for UK OSPAR Common Procedure -	The Centre for Environment, Fisheries, and	The dataset includes parameters of chlorophyll (by fluorometry), dissolved oxygen, salinity and

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
				Eutrophication Assessment	Aquaculture Science (Cefas)	temperature, and nutrients (including nitrate, nitrite, total oxidized nitrogen, ammonium, phosphate and silicate) from 1999 to 2014 with sea areas around the UK.
				HELCOM PLC Database	Baltic Marine Environment Protection Commission (Helsinki Commission - HELCOM)	The database contains all waterborne nutrient and contaminant discharges stemming from HELCOM pollution load monitoring.
				CLiP South Africa Microplastics in Biota 2019	The Centre for Environment, Fisheries, and Aquaculture Science (Cefas)	The dataset reports microplastic abundance in biota samples (anchovies, redeye round herring and sardines) collected and analyzed in South Africa in 2019.
				Global Ocean Biogeochemistry Analysis and Forecast from Copernicus	European Commission	This product includes daily and monthly mean files of biogeochemical parameters (chlorophyll, nitrate, phosphate, silicate, dissolved oxygen, dissolved iron, primary production, phytoplankton, PH, and surface partial pressure of carbon dioxide) over the global ocean.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
				Global Ocean Biogeochemistry Hindcast from Copernicus	European Commission	It provides 3D biogeochemical fields for the time period 1993-2019 at 1/4 degree and on 75 vertical levels.
			Methodologies	Large Marine Ecosystems: Status and Trends	GEF-TWAP Large Marine Ecosystem Assessment	This handbook introduces the details about how the ICEP, floating plastic debris, pollution status of persistent organic pollutants (DDTs, HCHs, etc), and nutrient inputs from river systems to coastal waters are calculated in the GEF-TWAP Large Marine Ecosystem Assessment.
				Eutrophication Monitoring Guidelines by Remote Sensing for the NOWPAP Region (2007)	The Northwest Pacific Action Plan (NOWPAP)	These guidelines have been designed particularly for coastal managers in local government and professional researchers involved in translating satellite remote sensing data into information. It also provides useful tools for eutrophication monitoring.
				Procedures for Assessment of Eutrophication Status Including Evaluation of Land-based Sources of Nutrients for the	The Northwest Pacific Action Plan (NOWPAP)	The objective of these Procedures is to enable NOWPAP member states to assess the status and impacts of eutrophication in their respective sea areas by using

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
				NOWPAP Region		information obtained through existing monitoring activities.
				Sampling and Analysis Techniques for the Eutrophication Monitoring Strategy of MED POL	Regional Seas Programme of UNEP	The manual is designed to support the Short-term Eutrophication Monitoring Strategy (UNEP(DEC)/MED WG.231/14, 2003) of MED POL (UNEP/MAP) for the Mediterranean Sea.
				Assessment for Estuarine Trophic Status (ASSETS) Model	National Estuarine Eutrophication Assessment (NEEA)	The National Estuarine Eutrophication Assessment/ASSESSment of Estuarine Trophic Status (NEEA/ASSETS) is a screening model that uses a Pressure-State-Response framework to assess eutrophication.
				HELCOM Guidelines for the Annual and Periodical Compilation and Reporting of Waterborne Pollution Inputs to the Baltic Sea, (PLC-Water)	Baltic Marine Environment Protection Commission  (Helsinki Commission - HELCOM)	The guideline handbook reports the annual and periodical compilation and reporting of waterborne pollution inputs to the Baltic Sea by HELCOM. The report includes sampling strategies and evaluation methods on estimating inland nutrient input towards the sea.

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## Target 14.2 Sustainably manage and protect marine and coastal ecosystems

**Target 14.2** By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

**Indicator 14.2.1** Proportion of national exclusive economic zones managed using ecosystem-based approaches

**Status of indicator:** UNEP is responsible for developing methodologies for measuring Target 14.2. These were still under development in January 2019, but UNEP has produced a global manual of proxy indicators, developed in line with the regional seas core indicators.

**Custodian agency:** UNEP

**Key partner agencies:** IOC-UNESCO and FAO

Marine and coastal ecosystems provide a variety of social, economic, cultural, and environmental services (Buonocore et al., 2021), yet they are also under increasing pressures from development and land use practices. Open-source databases are important for the assessment and management of coastal and marine ecosystems to achieve the sustainable benefits from the oceans (Caro et al., 2018). National Governments are using different frameworks — such as marine spatial planning and ecosystem-based fisheries management — to balance and control human interactions with the oceans (Duarte et al., 2020).

### (1) Databanks

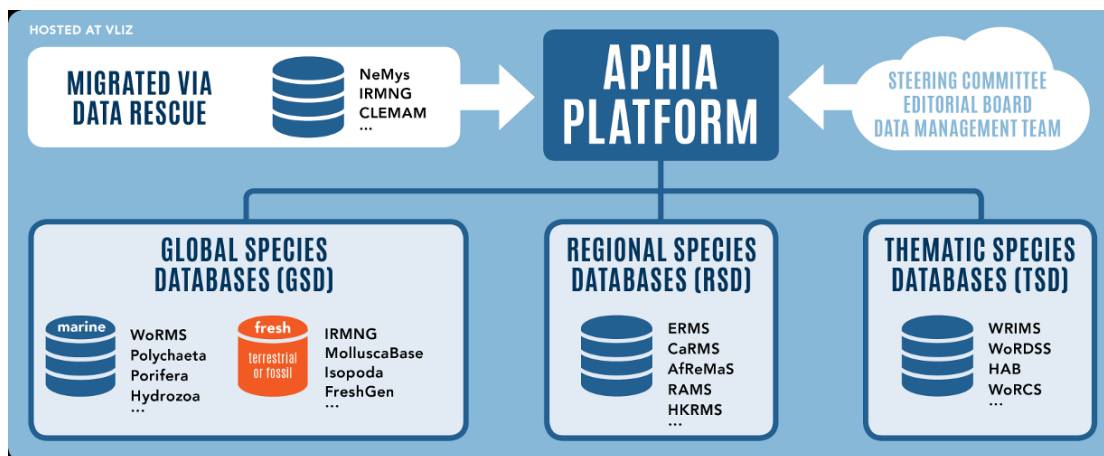
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➤ **Marine Ecosystem, Productivity and Biodiversity**

1) ***World Register of Marine Species (WoRMS)*** (<http://marinespecies.org/index.php>)

World Register of Marine Species (WoRMS) aims to provide an authoritative and comprehensive list of marine organisms. Data downloads include taxonomic data and are provided in Darwin core (CSV format). WoRMS combines information from Aphia with other authoritative marine species lists, which are maintained by other externally hosted and managed species databases, such as AlgaeBase and FishBase. WoRMS provides the Taxon Match Tool to match a given list of species or taxon lists with WoRMS. After matching, the tool will return a file with the AphiaID's, valid names, authorities, WoRMS classification and/or any other selections. WoRMS webservice is also available to users and developers to feed specific applications with standard WoRMS data.

Aphia is the core platform that underpins the WoRMS and all its related global, regional and thematic species databases. The infrastructure is designed to capture taxonomic and related data and includes an online editing environment. Aphia uses unique and stable identifiers for each available name in the database through Life Science Identifiers (LSIDs). The system not only allows the storage of accepted and unaccepted names, but also documents the relationship between names.



Aphia platform

The content of WoRMS is controlled by taxonomic and thematic experts. WoRMS has an editorial management system where each taxonomic group is represented by an expert

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who has the authority over the content and is responsible for controlling the quality of the information. New information is entered daily by the taxonomic editors and by the members of the data management team. Data also come from large datasets, such as global or regional species lists.

## **2) The World Register of Deep-Sea Species (WoRDSS)**

(<http://www.marinespecies.org/deepsea/contribute.php>)

The World Register of Deep-Sea Species (WoRDSS) is a taxonomic database of deep-sea species based on the World Register of Marine Species (WoRMS). The WoRDSS project provides an open-access source of quality taxonomic information and imagery on deep-sea species, and at the same time enhances the WoRMS database through the provision of images, new sources and editorship. The WoRDSS site was launched in December 2012 as a project of the International Network for Scientific Investigation of Deep-sea Ecosystems (INDEEP). The current criteria for inclusion in the WoRDSS database consists of a sample depth of greater than 500 m, including both pelagic and benthic species.

WoRDSS developed the Deep-Sea ID application to improve access to taxonomic information for educators and science communicators, as well as researchers and contractors working at sea. This app is a unique visual identification guide to WoRDSS that currently stores on devices facilitating offline access the taxonomic information for over 25,000 deep-sea species, over 580 high-resolution photographs of deep-sea species, as well as links to online taxonomic tools, sources and important references.

## **3) Ocean Biodiversity Information System (OBIS)** (<https://obis.org/>)

OBIS is a global open-access data and information clearing house on marine biodiversity for science, conservation, and sustainable development. The system provides search capabilities through taxa, common names, datasets, nodes, institute, area, and provider country. OBIS datasets follow the standards of Darwin core, ecological metadata language, Darwin core archive and dataset structure. OBIS provides periodic exports of the entire set of quality-controlled presence records as CSV, which is the easiest way to



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download data for large scale analyses.

The online Mapper tool allows users to visualize and inspect subsets of OBIS data. A variety of filters (taxonomic, geographic, time, data quality) is available and multiple layers can be combined in a single view. Layers can be downloaded as CSV files and the *robis* R package provides direct access to the OBIS database.

OBIS is part of Intergovernmental Oceanographic Commission (IOC)'s Medium-Term Strategy, 2014-2021, adopted by the IOC Resolution XXVII-2(B) and United Nations Educational, Scientific and Cultural Organization (UNESCO) Resolutions 37 C/4. OBIS works to be the most comprehensive gateway to the world's ocean biodiversity and biogeographic data and information required to address pressing coastal and world ocean concerns. More than 20 OBIS nodes around the world connect 500 institutions from 56 countries. Collectively, they have provided over 45 million observations of nearly 120,000 marine species. The datasets are integrated so users can search and map them all seamlessly by species name, higher taxonomic level, geographic area, depth, time, and environmental parameters. OBIS emanates from the Census of Marine Life (2000-2010) and was adopted as a project under IOC-UNESCO's IODE programme in 2009.

#### 4) **AlgaeBase** (<https://www.algaebase.org/>)

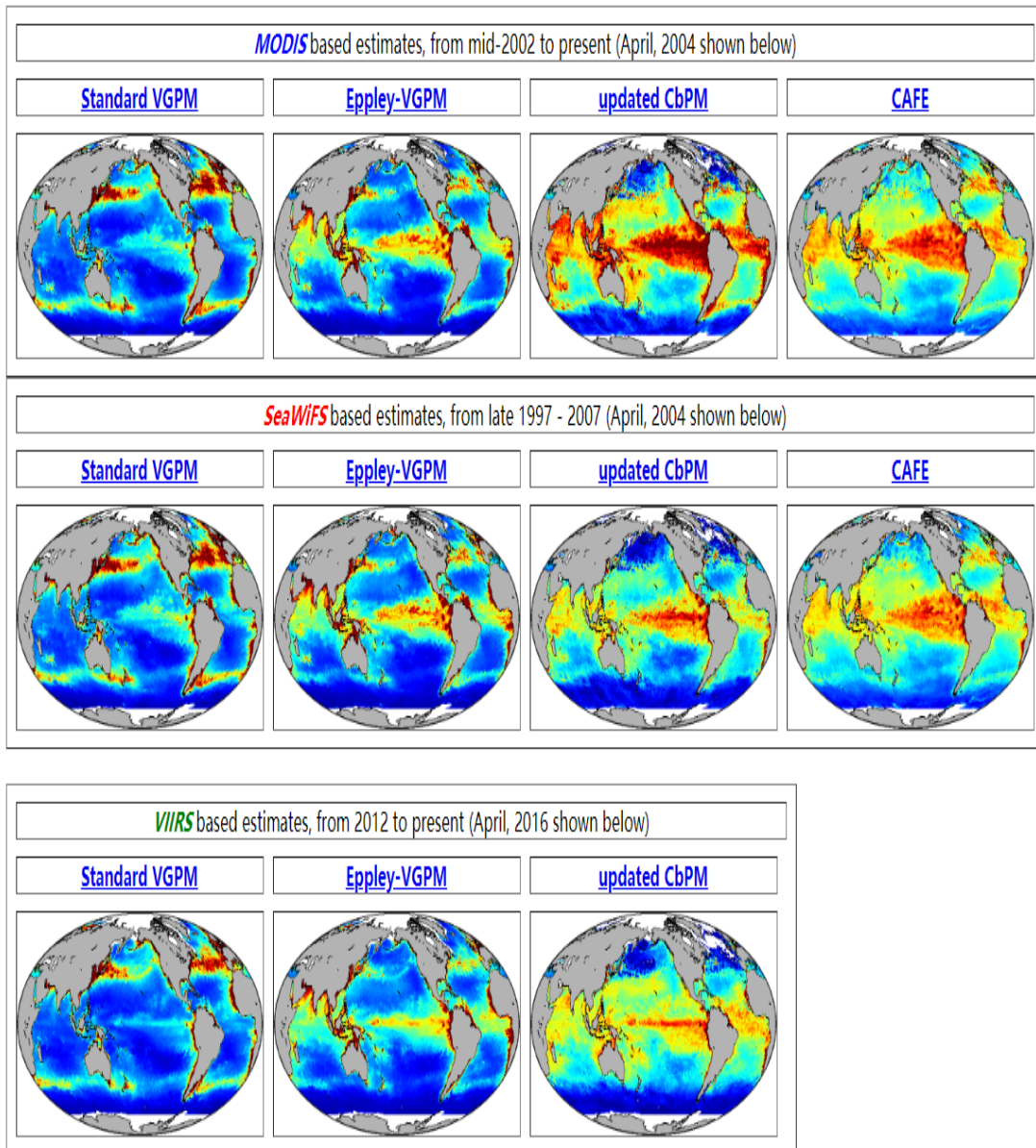
AlgaeBase is a database of information on algae that includes terrestrial, marine and freshwater organisms. The comprehensive information system includes a database on terrestrial microalgae, integrating taxon, type, name, and collection data as well as ecological and molecular information. At present, the data for marine algae, particularly seaweeds, are the most complete. As of July 2022, there are 166,843 species and infraspecific names, 22,910 images, 64,531 bibliographic items, and 504,469 distributional records. Data on AlgaeBase are based mainly on published information. AlgaeBase data are accessible through RESTful API to those who have obtained a valid API key. The data are provided in JSON format, facilitating the retrieval of species, genus, and classification records. The API uses universally recognized metadata sets as defined by the Dublin Core Initiative and its subset Darwin Core, as well as some metadata that are unique to AlgaeBase.

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Michael Guiry is the Founder and Director of the AlgaeBase project. Wendy Guiry is the principal collaborator on the AlgaeBase project. AlgaeBase is sponsored by the Phycological Society of America, the British Phycological Society, the International Phycological Society, and the Korean Phycological Society.

**5) *Ocean Productivity*** (<http://sites.science.oregonstate.edu/ocean.productivity/>)

Ocean Productivity aims to provide the science and broader communities with global, updated ocean productivity estimates. In addition, the website delivers information on the models employed, gives access to model code and ancillary data sets, and makes comparisons of productivity estimates for alternative models. Field datasets relevant to ocean productivity modeling are also provided and will be continually expanded as new data become available. The website provides a single productivity product as a Standard product using the Vertically Generalized Production Model (VGPM), which is a "chlorophyll-based" model that estimates net primary production from chlorophyll. For the VGPM, net primary production is a function of chlorophyll, available light, and the photosynthetic efficiency. Their custom products present ocean productivity estimates for different satellite data sets and alternative productivity algorithms.



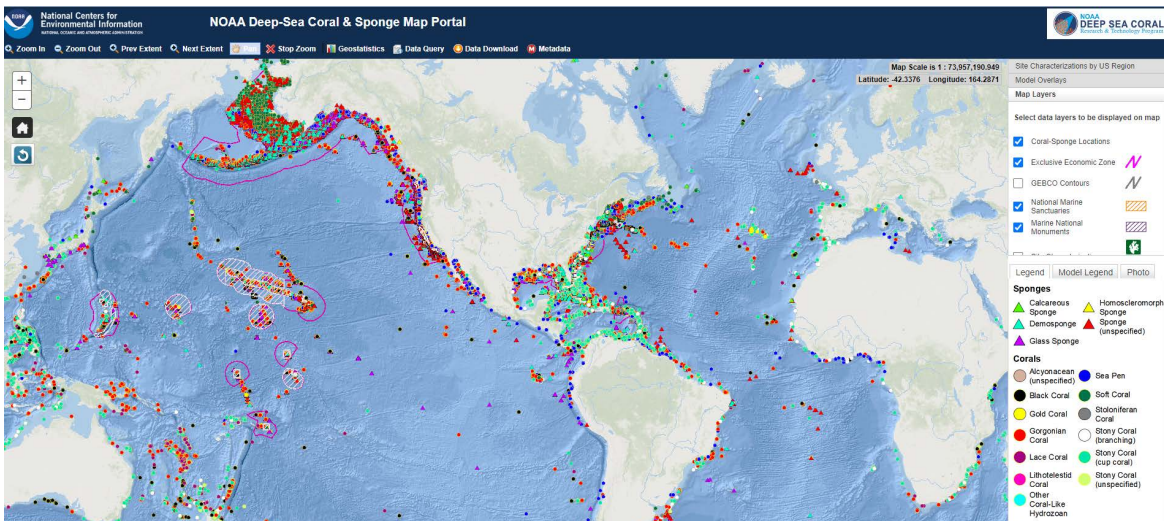
[Ocean Productivity website](#)

**6) NOAA Deep-Sea Coral Data** (<https://deepseacoraldata.noaa.gov/>)

This website provides access to deep-sea coral and sponge data, images, and technical reports from research funded by NOAA's Deep-Sea Coral Research and Technology Program and its partners. NOAA Deep-Sea Coral & Sponge Map Portal allows for search, discovery, and download of the National Deep-Sea Corals and Sponges Database. All points are categorized and colored by common vernacular categories. Users

can search by taxon, region, time, and depth. Data downloads can be initiated using the search parameters on the map and the on-screen geographic extent. A standard download file will contain the following fields: catalog number, data provider, scientific name, vernacular name category, taxonomic rank, station, shallow flag, observation date, position (latitude, longitude), locality, location accuracy, depth, depth method, repository, identification qualifier, sampling equipment, record type, event ID, survey ID, dataset ID, and sample ID.

NOAA Deep-Sea Coral & Sponge Map Portal is supported by The Deep-Sea Coral Research and Technology Program (DSCRTP), which aims to provide scientific information needed to conserve and manage deep-sea coral and sponge ecosystems. The program supports new research and curates existing information into a comprehensive deep-sea coral resource. National Centers for Coastal Ocean Science (NCCOS) and National Centers for Environmental Information (NCEI) were instrumental in constructing the DSCRTP website and national database. The habitat reports were provided by program partners at NOAA Fisheries Science Centers, the Office of National Marine Sanctuaries, University of North Carolina - Wilmington, and Harbor Branch Oceanographic Institute.



NOAA Deep-Sea Coral & Sponge Map Portal

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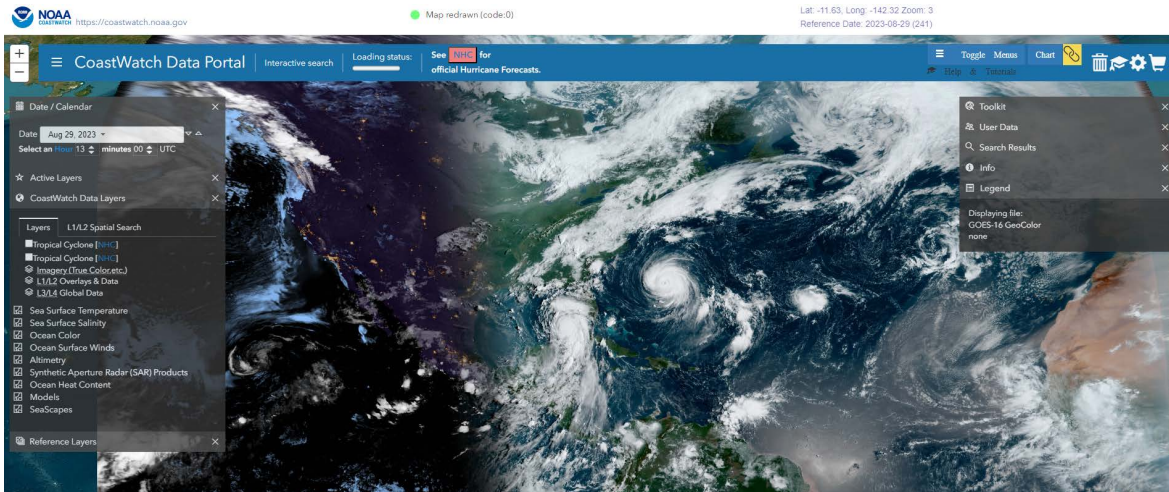
➤ **Coastal Ecosystem and Habitat**

1) ***NOAA CoastWatch • OceanWatch*** (<https://coastwatch.noaa.gov/cw/index.html>)

NOAA CoastWatch • OceanWatch provides satellite data products and services at global and regional spatial resolution for understanding and managing our oceans and coasts. The programme aims to facilitate the use of ocean satellite data to improve outcomes. The platform allows for easy access to global and regional satellite data products for use in understanding, managing, and protecting ocean and coastal resources and for assessing impacts of environmental change in ecosystems, weather, and climate. As of May 2022, 776 CoastWatch datasets are available, including daily chlorophyll data from Copernicus S-3A OLCI and Copernicus S-3B OLCI, ice concentration, ice surface temperature, ice thickness, sea surface temperature, winds and current products, and ocean color radiometry data, among others.

A software “CoastWatch Utilities 3.7.0 (b107)” was developed to let users work with earth science data created by NOAA CoastWatch • OceanWatch. Users can easily view and convert data in various formats: HDF 4, NOAA 1b, and NetCDF 4. The software has both interactive and batch processing tools. The functionality includes information and statistics, data processing, graphics and visualization, registration and navigation, and data download.

CoastWatch Data Portal is intended to provide visual access to CoastWatch oceanographic satellite data. It can also be used as a data viewer with map controls such as pan and zoom. Layers can be viewed simultaneously, and the gridded or mapped data can be downloaded as a full extent or subset dataset in NetCDF for local analysis.



## CoastWatch Data Portal

The NOAA CoastWatch Program is based in NOAA/NESDIS/Satellite Application and Research (STAR)/ Satellite Oceanography and Climatology Division (SOCD) and cross-NOAA Line Office Nodes. The Central Operations team is primarily based in College Park, MD. The CoastWatch Regional Nodes are distributed geographically across the country and housed in various NOAA Line Offices. The CoastWatch Nodes currently include three in NOAA Fisheries (NMFS), two NOAA Research (OAR), and one in the National Ocean Service (NOS). Together, these 3 pillars support the CoastWatch mission to help people use satellite data in their ocean, coastal and inland water applications.

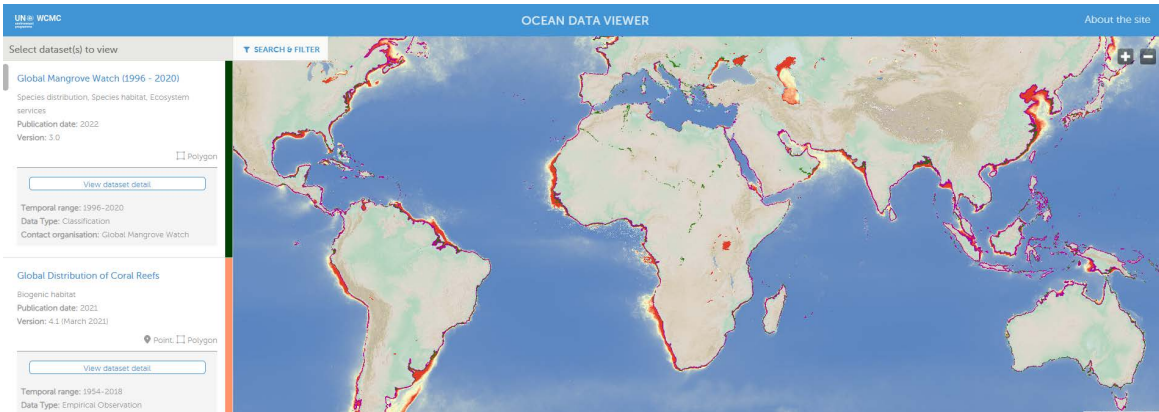
## **2) Ocean Data Viewer** (<https://data.unep-wcmc.org/>)

The Ocean Data Viewer offers the opportunity to view and download a range of spatial datasets that are useful for informing decisions regarding the conservation of marine and coastal biodiversity. These data come from internationally respected scientific institutions and other organizations that have agreed to make their data available to the global community, with the hope that these data will support and encourage informed decision-making that sustains global biodiversity and ecosystem services. The Ocean Data Viewer is primarily a mechanism to view and download data and is not intended to be used for analysis or to query data. A list of datasets can be downloaded from the following link: [http://wcmc.io/ODV\\_data](http://wcmc.io/ODV_data). UN Environment Programme World Conservation Monitoring



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Centre (UNEP-WCMC) provides an Ocean+Habitats ATLAS User Manual to introduce the various challenges, gaps and limitations that can be presented by coastal and marine datasets, and particularly by those at the global scale, including data features, data structure, data standard, data providers, data verification and formatting, quality assurance and release, data access, and more.



### The Ocean Data Viewer

Ocean Data Viewer is supported by UN-WCMC. Based in Cambridge, UK, UNEP-WCMC is a collaboration between UN Environment Programme and the UK charity, WCMC. UNEP-WCMC works with scientists and policymakers worldwide to place biodiversity at the heart of environment and development decision-making and thus enable enlightened choices for people and the planet. UNEP-WCMC is concerned with the multiple values of biodiversity, particularly where it is at risk, and the relationship between biodiversity and ecosystem services that deliver human benefits. The organization aims to provide authoritative information about biodiversity and ecosystem services in a way that is useful to decision makers who are driving changes in environment and development policy.

### **3) Global Mangrove Watch** (<http://www.globalmangrovewatch.org/>)

Global Mangrove Watch (GMW) is an online platform that provides remote sensing data and tools necessary for monitoring mangroves. It gives universal access to near real-time information about conditions in mangroves around the world, while highlighting why these ecosystems are valuable. Mangrove monitoring aims to catalyze the action needed to

protect and restore mangroves. With high resolution information on topography, soil conditions and hydrology, Global Mangrove Watch gives coastal and park managers, conservationists, policymakers and practitioners the evidence needed to respond to illegal logging, pinpoint the causes of local mangrove loss and track restoration progress. It is a tool that can help mangroves be central to climate mitigation, adaptation and sustainable development plans and policies.



### The Global Mangrove Watch platform

GMW was established in 2011 under the Japan Aerospace Exploration Agency (JAXA)'s Kyoto & Carbon Initiative by Aberystwyth University, solo Earth Observation and the International Water Management Institute, with the aim to provide open access geospatial information about mangrove extent and changes to the Ramsar Convention on Wetlands. With support from the Oak Foundation, COMON Foundation, DOB Ecology and the Dutch Postcode Lottery, The Nature Conservancy, Wetlands International, Aberystwyth University, and soloEO in 2019 initiated a deeper collaboration, and are working with NASA, JAXA, International Water Management Institute (IWMI), UNEP-WCMC and a host of partners to develop the GMW Platform.



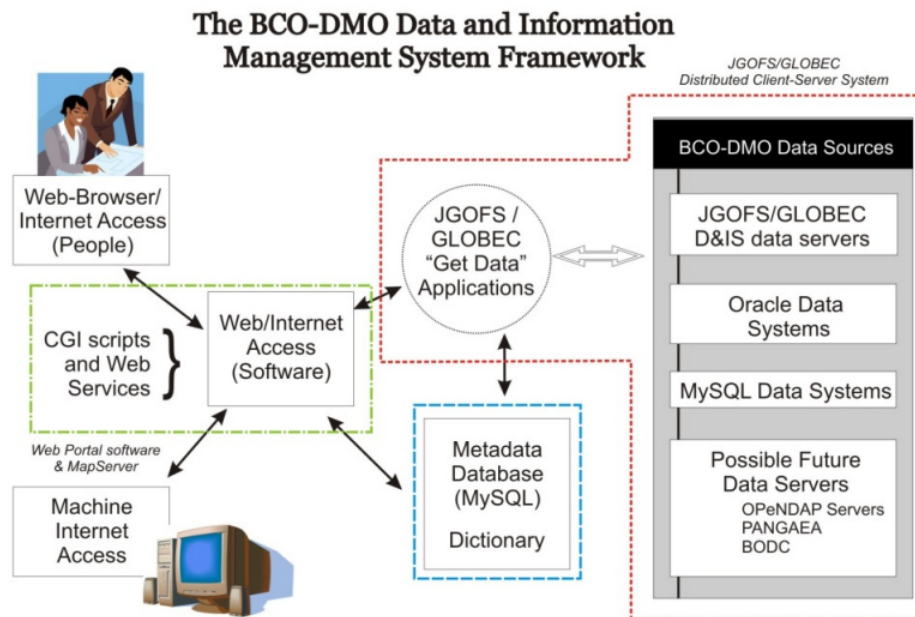
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4) ***Jellyfish Database Initiative*** (<https://www.bco-dmo.org/dataset/526852>)

The Jellyfish Database Initiative (JeDI) is a scientifically coordinated global database dedicated to gelatinous zooplankton (members of the Cnidaria, Ctenophora and Thaliacea taxonomic groups) and associated environmental data. The database holds 476,000 quantitative, categorical, presence-absence and presence-only records of gelatinous zooplankton spanning the past four centuries (1790-2011) assembled from a variety of published and unpublished sources. Gelatinous zooplankton data are reported to species level where identified, but taxonomic information on phylum, family and order are reported for all records. Other auxiliary metadata, such as physical, environmental, and biometric information, are included with each respective entry. JeDI has been developed and designed as an open access research tool for the scientific community to quantitatively define the global baseline of gelatinous zooplankton populations and to describe long-term and large-scale trends in gelatinous zooplankton populations and blooms.

JeDI is supported by the Biological and Chemical Oceanography Data Management Office (BCO-DMO), located in the Woods Hole Oceanographic Institution, and is a combination of the formerly independent Data Management Offices formed in support of the US JGOFS and US GLOBal Ocean Ecosystems Dynamics (US GLOBEC) programs. The BCO-DMO staff members are the curators of the data collections created by those respective programs, as well as data from more recent National Science Foundation (NSF) Geosciences Directorate (GEO) Division of Ocean Sciences (OCE) Biological and Chemical Oceanography Sections, Division of Polar Programs (PLR) Antarctic Sciences (ANT) Organisms & Ecosystems, and Arctic Sciences (ARC) awards. The BCO-DMO project is funded by NSF, OCE and ANT programs.

The data management philosophy of BCO-DMO is based on many years of experience in collecting, processing and managing biological, chemical, geological, and physical oceanographic measurements and can be summarized as providing support “from proposal to preservation”.



The BCO-DMO data and information management system

➤ **Ecological Disasters**

1) **Harmful Algal Event Database** (<https://obis.org/dataset/62ddad25-2a19-485d-9bae-7eb3a40a71c5>)

The Harmful Algal Event Database (HAEDAT) is a meta database containing records of harmful algal events. HAEDAT contains records from the International Council for the Exploration of the Sea (ICES) area (North Atlantic) since 1985, and from the North Pacific Marine Science Organization (PICES) area since 2000. The IOC of UNESCO Regional networks in South America, South Pacific and Asia, and North Africa are preparing to contribute. The HAEDAT database contains information based on yearly national reports by ICES and PICES member states. The available information on individual events varies greatly from event to event or country to country. Furthermore, areas with numerous recorded occurrences of HAE's, but with an efficient monitoring and management programmes, may have very few problems and a low risk of intoxications, whereas rare HAE's in other areas may cause severe problems and represent significant health risks.

The HAEDAT is a component of the Harmful Algal Information system (HAIS)

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within the IODE of the IOC, and in cooperation with ICES, and PICES.

➤ **Ecological Conservation and Restoration**

1) **IUCN Red List** (<https://www.iucnredlist.org/>)

The International Union for Conservation of Nature’s (IUCN) Red List of Threatened Species is a critical indicator of the health of the world’s biodiversity. Far more than a list of species and their status, it’s a powerful tool to inform and catalyze action for biodiversity conservation and policy change, critical to protecting the natural resources we need to survive. It provides information about range, population size, habitat, and ecology, use and/or trade, threats, and conservation actions that will help inform necessary conservation decisions. As of July 2022, more than 142,577 species have been assessed for the IUCN Red List. The IUCN Red List Categories and Criteria are intended to be an easily and widely understood system for classifying species at high risk of global extinction. It divides species into nine categories: Not Evaluated, Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct.

The IUCN Red List was established in 1964. Since then, the IUCN Red List of Threatened Species has evolved to become the world’s most comprehensive information source on the global conservation status of animal, fungi and plant species.

**(2) Methodologies**

1) **Proportion of national exclusive economic zones managed using ecosystem-based approaches**

SDG Indicator 14.2. refers to the management of exclusive economic zones using ecosystem-based approaches. The Global Manual on Ocean Statistics compiled in February 2018 provides guidance for implementing indicator under UN Environment Programme custodianship.

From an ecological perspective, ecosystem-based approaches consider the connections between the living organisms, habitats, physical and chemical conditions

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within an ecosystem, focusing on the importance of ecological integrity, biodiversity, and overall ecosystem health. From a management perspective, ecosystem-based approaches refer to integrated management strategies for socio-ecological systems that consider ecological, social and economic factors and apply principles of sustainable development. These different ways of interpreting the ‘ecosystem-based approach’ are reflected in existing indicators. A review of these indicators and their underlying methodologies shows two ways in which Regional Seas Program and other key intergovernmental, international or regional bodies are monitoring and assessing the implementation of ecosystem-based approaches.

### **2) Ocean Health Index** (<https://ohi-science.org/>)

The Ocean Health Index (OHI) is a scientific framework used to measure how healthy oceans are. The underlying philosophy behind the Index is that a healthy ocean sustainably delivers a range of benefits to people now and in the future. Understanding the state of our oceans is a first step towards ensuring they can continue providing benefits to people now and in the future.

For the global study that underpins the OHI, participating scientists, economists, and sociologists reviewed existing surveys of what people want and expect from the ocean and then grouped them into ten categories called ‘goals’. Each goal measures the delivery of specific benefits with respect to a sustainable target. A goal is given a score of 100 if its benefits are maximized without compromising the ocean’s ability to deliver those benefits in the future. Lower scores indicate that more benefits could be gained or that current methods are harming the delivery of future benefits.

### **3) Ecosystem Health Report Cards**

One of the most important approaches to ensuring the protection and sustainable development of marine environments and resources is to establish ecosystem-based management practices that maintain a healthy ocean ecosystem. Ecosystem health report cards have become increasingly important for communicating information about the marine environmental state and assessing progress towards management goals. Many

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analytical methods underpinning the translation of observed data into robust health indices have been developed. Report cards are communication tools built on ecosystem monitoring and management tools, which are responsible for integrating and distilling scientific understanding. Marine ecosystem health assessments can be used to inform decision-making and provide direct, high-quality information to guide sustainable coastal land use and development. It can also help to improve an ecologically sound management strategy for sustainable use and development of coastal areas.

Methodology of report cards has been developed by the Australian Institute of Marine Science, and the Institute of Oceanology of the Chinese Academy of Sciences has been applied successfully to assess ecosystem health in Jiaozhou Bay, China. With a focus on SDG 14.2, a selection of indicators and guideline settings were reviewed to gain a better understanding of ecosystem structure, services, functions, and ecological disasters and diseases. Guidelines, thresholds, and reference settings in existing health assessments were improved using machine learning to translate monitoring, observation, and research results into information that could be understood by the public and policymakers. Using this method, ecosystem health indices are typically converted into a single five-point alphanumeric Grade (A-E) along a compliance rating scale with an associated ‘traffic light’ like color scheme. The grade boundaries are usually determined by experts to ensure that the range of indices represented by each grade classification is congruent with community interpretation of a letter grade report card.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
14.2 <i>By 2020 sustainably manage and protect marine and coastal ecosystems</i>	<b>14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches</b>	UNEP, IOC-UNESCO and FAO	Databanks	WoRMS	WoRMS Steering Committee, Editorial board and Data Management Team (DMT)	Provides an authoritative and comprehensive list of names of marine organisms, including information on synonymy.
				WoRDSS	WoRMS Steering Committee, Editorial board and DMT	A taxonomic database of deep-sea species based on the WoRMS.
				OBIS	UNESCO, IOC-UNESCO, IODE, IODE Steering Group for OBIS (SG-OBIS), OBIS-EC	A global open-access data and information clearing house on marine biodiversity for science, conservation and sustainable development.
				Algaebase		A database of information on algae that includes terrestrial, marine and freshwater organisms.
				Ocean Productivity		Supplies the science and broader communities with global, updated ocean productivity estimates.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
				NOAA Deep-Sea Coral Data	NOAA, DSCRTP, NCEI, NCCOS	Provides access to deep-sea coral and sponge data, images, and technical reports.
				NOAA CoastWatch • OceanWatch	NOAA/NESDIS/STAR/SOCD and cross-NOAA Line Office Nodes	Provides satellite data products and services at global and regional spatial resolution.
				Ocean Data Viewer	UNEP-WCMC	A range of spatial datasets that are useful for informing decisions regarding the conservation of marine and coastal biodiversity.
				Global Mangrove Watch	Global Mangrove Watch Platform	Provides the remote sensing data and tools for monitoring mangroves.
				Jellyfish Database Initiative	BCO-DMO of Woods Hole Oceanographic Institution	A global database dedicated to gelatinous zooplankton (members of the Cnidaria, Ctenophora and Thaliacea) and associated environmental data.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
				Harmful Algal Event Database	HAIS, IOC-UNESCO, ICES, PICES	A meta database containing records of harmful algal events.
				IUCN Red List	IUCN	Red List of Threatened Species.
			Methodologies	Proportion of national exclusive economic zones managed using ecosystem-based approaches	UNEP	Guidance for implementing the SDG Indicator 14.2.1.
				Ocean Health Index	The National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California at Santa Barbara (UCSB)	A scientific framework used to measure status of ocean health.
				Ecosystem Health Report Cards	Australian Institute of Marine Science, the Institute of Oceanology, Chinese Academy of Sciences	Methodologies for the assessment of marine ecosystem health.



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## Target 14.3 Minimize and address the impacts of ocean acidification

**Target 14.3** Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

**Indicator 14.3.1** Average marine acidity (pH) measured at agreed suite of representative sampling stations

**Status of indicator:** IOC-UNESCO has developed a methodology for monitoring and observing ocean acidification. In November 2018, the UN Inter-agency and Expert Group on SDG indicators (IAEG-SDGs) upgraded the indicator for Target 14.3 from Tier 3 to Tier 2.

Custodian agency: IOC-UNESCO

Partner agency: UNEP

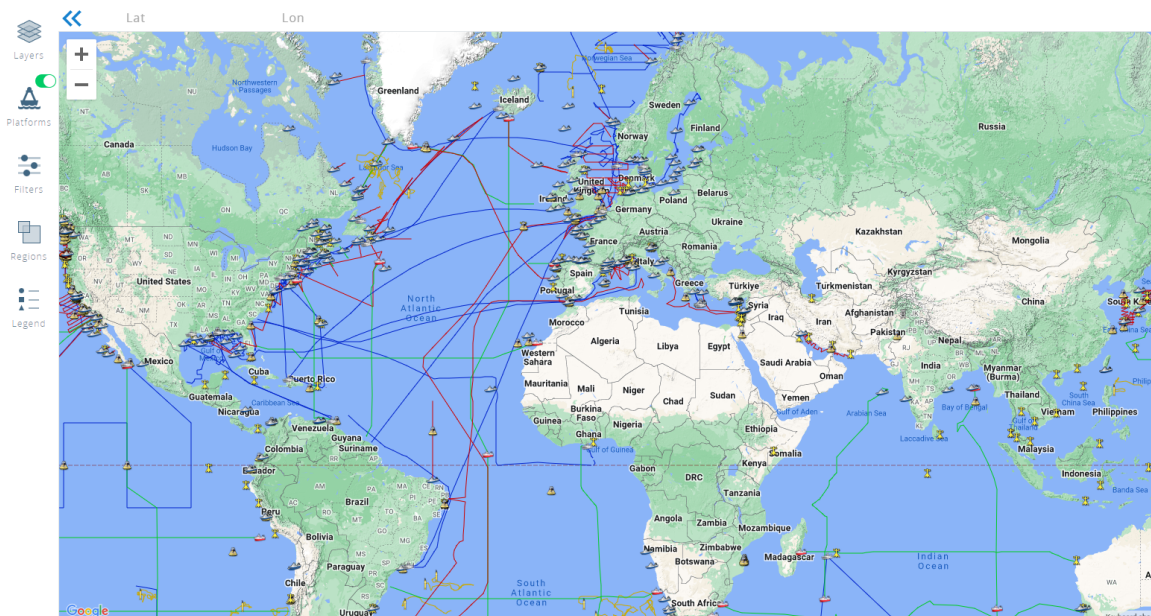
Ocean acidification has increased since pre-industrial times due to rising carbon dioxide emission dissolving into oceans. The chemical changes to seawater caused by ocean acidification and other processes will lead to significant impacts on organism physiology, behavior, and habitat range, particularly calcifying species such as oysters, clams, sea urchins, corals, and calcareous plankton (Clements et al., 2017; Doney et al., 2020; Falkenberg et al., 2020). There have been several international conventions on reducing ocean acidification and improving the management of its impacts (Cooley et al., 2016). Due to the lack of ocean acidification data, the extent of the impacts of ocean acidification is still relatively unknown, which makes developing management plans and other mitigation strategies difficult (Hilmi et al., 2013).

### (1) Databanks

#### 1) *Global Ocean Acidification Observing Network (GOA-ON) Data Portal*

(<http://portal.goa-on.org/explorer>)

The GOA-ON Data Portal works to improve understanding of global ocean acidification conditions and ecosystem responses by making ocean acidification data easily accessible. The GOA-ON Data Explorer provides access to and visualization of ocean acidification data and data synthesis products being collected around the world from a wide range of sources, including moorings, research cruises, and fixed time series stations. Layers contain contoured world-wide data, and platforms include icons for various observing assets, some of which display real-time data and many of which include links to data and metadata. For a given asset measuring carbonate chemistry, metadata includes information on which parameters are measured, links to data providers, and other useful details. The inventory of GOA-ON assets can be searched interactively by region, platform type, and variables using the Filters tool. It is free to become a member of GOA-ON, and new platforms can be added to the portal.



The GOA-ON Data Portal

GOA-ON is a collaborative international network to detect and understand the drivers of ocean acidification in estuarine-coastal-open ocean environments and the resulting impacts on marine ecosystems, and to make the information available to optimize modelling studies. The network is fundamental to providing early warning of the impacts of ocean acidification on natural ecosystems, wild and aquaculture

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fisheries, coastal protection, tourism and local economies. The network also supplies key input to communities, industry and governments seeking to develop action plans, best practices, and mitigation or adaptation strategies to address ocean acidification impacts. GOA-ON delivers the coordinated, global approach essential to avoid duplication of efforts and to define a common research strategy. The institution is expanding rapidly and

currently involves over 400 scientists from more than 100 countries around the world, all contributing to the development of a common strategy to advance ocean acidification monitoring worldwide.

**2) *OA-ICC Ocean Acidification Biological Response Data Portal* (<http://oa-icc.ipsl.fr/>)**

The user-friendly data portal, focusing on the impacts of ocean acidification on marine organisms, was developed by the International Atomic Energy Agency (IAEA) Ocean Acidification International Coordination Centre (OA-ICC). The data compilation includes studies on the biological response to ocean acidification and is maintained in close cooperation with the State Key Laboratory of Marine Environmental Science at Xiamen University and the World Data Center Pangaea hosted by the Alfred Wegener Institute (AWI), Helmholtz Center for Polar and Marine Research and the Center for Marine Environmental Sciences at the University of Bremen (MARUM). The goal of this data compilation is to ensure the archiving and streamlining of data on the biological response to ocean acidification, as well as to provide easy access to the data for all users. Data can be retrieved by searching spatial information, experimental information, biological information, and bibliographic information. Published data are made available to the scientific community in a coherent format and with a citable Digital Object Identifier (DOI). Data were extracted directly from tables or figures in published papers, or downloaded from other data repositories such as the BCO-DMO, the British Oceanographic Data Centre (BODC) and the Australian Antarctic Data Centre (AADC). The compilation currently includes data from over 1,230 data sets from more than 1,250 papers.



### The OA-ICC Ocean Acidification Biological Response Data Portal

OA-ICC is an IAEA Peaceful Uses Initiative project launched at the UN Rio+20 conference in 2012 following increasing concern about ocean acidification. The Centre responds to the need to coordinate, promote and facilitate global ocean acidification activities, and fosters the development of data portals, standardized methodology and best practices. OA-ICC works with many international partners and supports global and regional ocean acidification networks, including the Global Ocean Acidification Observing Network. The OA-ICC has received direct and in-kind contributions from eight IAEA Member States (Australia, France, Italy, Japan, New Zealand, Sweden, UK and USA) as well as key international organizations and projects (International Convention for the Safety of Life at Sea (SOLAS), Integrated Marine Biosphere Research (IMBeR), the UK Ocean Acidification Programme, and the European Mediterranean Sea Acidification in a changing climate (MedSeA) project of the European Commission).

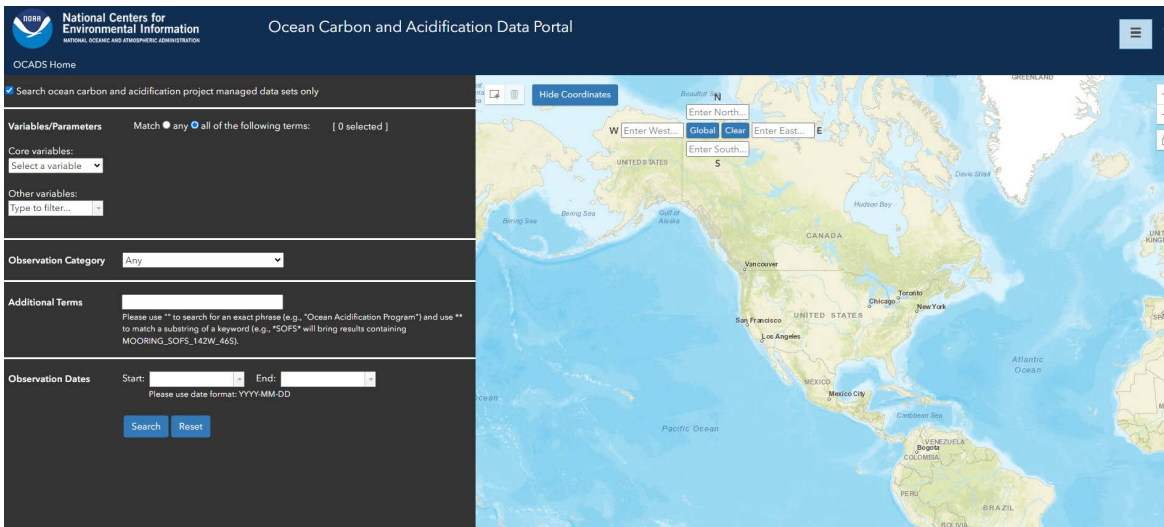
OA-ICC also hosts a bibliographic database supported by Zotero, which was registered on 22 June 2018. Data include journal articles, MSc and PhD dissertations, books, and book chapters, with every entry in the bibliography made with a standardized format. The database, initially organized in 1922, and has been consistently maintained, updating monthly. As of 2022, there are 9,625 items in OA-ICC group. The database is open to

the public.

### 3) **NOAA Ocean Carbon and Acidification Data Portal (OCADP)**

(<https://oceanacidification.noaa.gov/WhatWeDo/Data.aspx>)

NOAA's Ocean Acidification Program (OAP) funds the Ocean Acidification Data Stewardship (OADS) project to build a collaborative approach with shared responsibilities among scientists, data managers, and data partners. OADS ensures data collected from OAP-funded research is archived and accessible for ocean acidification analyses, forecasting capabilities, and assessments of marine resource vulnerability. The databank supports require core variables, including total alkalinity, dissolved inorganic carbon, partial pressure of CO<sub>2</sub> and fugacity of CO<sub>2</sub> in surface water ( $p\text{CO}_2/f\text{CO}_2\text{-water}$ ), pH, ammonia/ammonium, apparent oxygen utilization, aragonite saturation state, chloroflourocarbons (CFC-11,12,113), chlorophyll, chromophoric dissolved organic matter, delta C13, delta C14, delta He3, delta N15, delta O18, dissolved organic carbon, fluorescence, methane, nitrate, nitrate+nitrite, nitrous oxide, oxygen, particulate organic carbon, phosphate, salinity, silicate, sulfur hexafluoride, temperature, tritium, xCO<sub>2</sub>-atmosphere and other variables, based on categories and date of observation.



### The NOAA Ocean Carbon and Acidification Data Portal

OAP was launched in 2011 to build relationships between scientists, resource

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managers, policymakers and the public to research and monitor the effects of changing ocean chemistry on important ecosystems, such as fisheries and coral reefs. The project monitors ocean acidification and conducts research to determine which ecosystems are most sensitive and which marine organisms are particularly susceptible to the resulting change in chemistry. The OAP also has an education and outreach focus to raise awareness and understanding about acidification.

## **(2) Datasets**

### **1) Surface Ocean CO<sub>2</sub> Atlas (SOCAT)**

SOCAT is maintained by Bjerknes Centre for Climate Research and the Integrated Carbon Observation System (ICOS), Ocean Thematic Centre (Bergen, Norway), including data of surface ocean  $f\text{CO}_2$  (fugacity of carbon dioxide). The first version of SOCAT was released in 2011, and the second and third version followed biennially. The latest SOCAT version (2021) has 30.6 million observations from 1957 to 2020 for the global oceans and coastal seas.

The Bjerknes Centre for Climate Research and the ICOS Ocean Thematic Centre also host the Global Ocean Data Analysis Project (GLODAP), which has datasets of salinity, oxygen, phosphate, nitrate, silicate, dissolved inorganic carbon, total alkalinity, pH, CFC-11, CFC-12, CFC-113, and CCl<sub>4</sub>. GLODAP was first published in 2004. The second version, GLODAPv2, was released in 2016. GLODAPv2.2021 contains data from more than 1.3 million water samples collected on 989 cruises.<sup>6</sup>

## **(3) Methodologies**

### **1) Indicator Methodology for 14.3.1** ([www.goa-on.org/resources/sdg\\_14.3.1\\_indicator.php](http://www.goa-on.org/resources/sdg_14.3.1_indicator.php))

The OA-ICC works with international partners to promote the development of new and simplified methodology to monitor ocean acidification and related data reporting guidelines. This includes work with IOC-UNESCO to develop a methodology for countries to report on the SDG 14 and its target 3 on ocean acidification. The methodology provides the necessary guidance on how to conduct ocean acidification observations, including what to measure and how, providing standard operating procedures and methods approved by the ocean acidification community. It further provides support for the kinds

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of data to collect and how to submit information towards the SDG 14.3.1 Indicator to IOC-UNESCO to enable the collection and comparison of ocean acidification data worldwide. The associated data and metadata files enable the collection and submission of the relevant data.

**2) *Guide to Best Practices in Ocean Acidification Research and Data Reporting***

(<https://www.iaea.org/sites/default/files/18/06/oa-guide-to-best-practices.pdf>)

To help ensure high-quality and comparable ocean acidification data, the OA-ICC promotes the use and development of guidelines on behalf of practices in ocean acidification research in order to provide comprehensive guidance to scientists undertaking ocean acidification studies.

<b>SDG Goal</b>	<b>SDG indicator</b>	<b>Agencies</b>	<b>Databases</b>		<b>Custodian agency</b>	<b>Description</b>
<i>14.3 Minimize and address the impacts of ocean acidification</i>	<b>14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations</b>	IOC- UNESCO, UNEP	Databanks	Global Ocean Acidification Observing Network (GOA-ON) Data Portal	GOA-ON	Gives access to and visualization of ocean acidification data and data synthesis products being collected around the world from a wide range of sources.
				OA-ICC Ocean Acidification Biological Response Data Portal	OA-ICC	Focuses on the impacts of ocean acidification on marine organisms, the data compilation includes studies on the biological response to ocean acidification.
				NOAA Ocean Carbon and Acidification Data Portal (OCADP)	OCADP	OADS archives and analyzes ocean acidification data collected from NOAA's Ocean Acidification Program (OAP)- funded research and supports data access to core variables of ocean acidification based on categories and date of observation.
			Datasets	Surface Ocean CO2 Atlas (SOCAT)	Bjerknes Centre for Climate Research and the ICOS, Ocean Thematic	Data of surface ocean $f\text{CO}_2$ of the global oceans and coastal seas based on 30.6 million observations from 1957 to 2020.



					Centre (Bergen, Norway)	
			Methodologies	Indicator Methodology for 14.3.1	OA-ICC	The methodology provides necessary guidance on how to conduct ocean acidification observations, and standard operating procedures and methods approved by the ocean acidification community.
				Guide to Best Practices in Ocean Acidification Research and Data Reporting	OA-ICC	The methodology provides comprehensive guidance to scientists starting ocean acidification studies.

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## Target 14.4 Restore fish stocks in the shortest time feasible

**Target 14.4** By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

**Indicator 14.2.1** Proportion of fish stocks within biologically sustainable levels

**Custodian agency:** FAO

Fisheries play a significant role in the livelihoods of the world population, with the dependence on fisheries being particularly acute in developing countries. Fisheries are a critical element for meeting the SDGs and FAO goals to reduce poverty, hunger and improve health and well-being (Lam et al., 2020). However, 90% of global marine fish stocks are fully or partially overexploited. Illegal, unreported, and unregulated (IUU) fishing is one of the threats to sustainable fish stocks. Failure to effectively manage world fish stocks can have disastrous effects on biodiversity and the livelihoods and socio-economic conditions of millions of people (Gebremedhin et al., 2021).

### (1) Databanks

#### 1) *Fishery and Aquaculture Statistical Collections* (<https://www.fao.org/fishery/en/home>)

The key activities of the FAO Fisheries and Aquaculture Division are to support and promote responsible and sustainable development in fisheries and aquaculture. The Fishery and Aquaculture Statistical Collections present comprehensive global and regional statistics on capture fisheries and aquaculture. Data are collected and managed by coherent and consistent statistical programs based on a common set of statistical standards. The Global Statistical Collections include Global Production, Global Aquaculture Production,

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Global Capture Production, Global Fish Trade and Processed Products Statistics, Consumption of Fish and Fishery Products, Global Tuna Catches by Stock, Global Number of Fishers, and Fisheries and Resources Monitoring System (FIRMS) Global Tuna Atlas (GTA). Regional Capture Statistical Collections include Eastern Central Atlantic (Fishery Committee for the Eastern Central Atlantic, CECAF), Mediterranean and Black Sea (General Fisheries Commission for the Mediterranean, GFCM), Regional Commission for Fisheries (RECOFI), and Southeast Atlantic.

2) ***WorldFish*** (<https://www.worldfishcenter.org/>)

WorldFish provides open-source data platforms to the research and development communities. The databank aims to contribute to ending hunger and advancing the achievement of the Sustainable Development Goals by 2030 through science and innovation, and by transforming food, land and water systems with aquatic foods for healthier people and planet.

FishBase operates under the WorldFish platform and is the premier biodiversity information website for fish species around the globe. As a global species database covering more than 32,000 species, FishBase includes a wide range of information on all fish species currently known including their biology, ecology, taxonomy, life history, trophic features, population dynamics and uses, as well as historical information dating back 250 years. FishBase also includes analytical and graphical tools that allow users to transform raw data into information that can be used to assess fisheries and identify management techniques to restore depleted fish stocks. WorldFish is an international non-profit research and innovation organization reducing hunger, malnutrition and poverty across Africa, Asia and the Pacific. It is also a part of One Constructive Group on International Agricultural Research (CGIAR), the world's largest agricultural innovation network.

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3) **Sea Around Us** (<http://www.seaaroundus.org/>)

The Sea Around Us database presents fisheries and fisheries-related data at spatial scales that have ecological and policy relevance, such as by Exclusive Economic Zones, High Seas, or Large Marine Ecosystems. The database provides simple map and advanced searches for a wider range of search options. The selected data sets can be downloaded from each page.

The website includes Taxon and Biodiversity tools and has both catch and taxonomic data by taxon or multiple taxa, including catch allocation data, available for download. The Sea Around Us R libraries allow researchers to download and manipulate data directly.

The Sea Around Us has several key research partners who collaborate with it on an ongoing basis. In addition, they engage with occasional, targeted sub-projects based on issues of common interest.

4) **Fishery Solutions Center** (<https://fisherysolutionscenter.edf.org/design-stories/chilean-national-benthic-resources-territorial-use-rights-fishing-program>)

The Fishery Solutions Center (FSC) is a team within the Environmental Defense Fund (EDF)'s Oceans program that designs and develops innovative fishery management tools and strategies to support efforts to reverse overfishing and restore our oceans to abundance. Scientists, economists, finance specialists and fishery management experts are dedicated to providing data-driven and incentive-based solutions that provide more fish in the sea, more food on the plate, and more prosperous communities. From developing innovative data collection programs to designing flexible management plans, FSC works with conservation groups, fishermen, governments, and other stakeholders around the world that seek new approaches to fishery management that allow both people and the oceans to thrive.

**(2) Datasets**

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1) **Global Capture Production** (<https://www.fao.org/fishery/en/collection/capture?lang=en>)

This database contains capture production statistics by country or territory, species item, and FAO Major Fishing Area. At present the data base shows annual figures for the period from 1950 organized by about 240 countries, territories or land areas; 26 major fishing areas; and approximately 1,600 species items (freshwater, brackish water and marine species of fish, crustaceans, molluscs and other aquatic animals and plants) classified into the FAO International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP)

2) **Database on Port State Measures** (<https://www.fao.org/fishery/en/psm/search>)

The Database on Port State Measures (Port-Lex) provides access to port state measures (PSM) adopted by States to prevent, deter and eliminate IUU fishing. Information can be accessed through a simple word search or advanced search using country names or measure components.

**(3) Methodologies**

1) **FishStatJ** (<https://www.fao.org/fishery/en/statistics/software/fishstatj>)

Software for Fishery and Aquaculture Statistical Time Series (FishStatJ) is a Windows and Mac application that anyone can use to access FAO's Fisheries and Aquaculture statistics. This includes datasets on production, trade and consumption. Data can be extracted and aggregated according to different level of details and international standard classifications. The platform consists of a main application and several workspaces that include the datasets.

2) **ARTFISH** (<http://www.oceansatlas.org/subtopic/en/c/1406/>)

Approaches, Rules and Techniques for Fisheries Statistical Monitoring (ARTFISH)

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has been formed as a standardized tool adaptable to most fisheries in the developing countries. Its design was driven by the need to provide users with robust, user-friendly and error-free approaches with computer software, and to achieve the implementation of cost-effective fishery statistical systems with minimal external assistance.

**3) OPEN ARTFISH** (<https://www.fao.org/fishery/en/statistics/software/open-artfish>)

OPEN ARTFISH stands for Open Approaches, Rules and Techniques for Fisheries Statistical Monitoring. It consists of the OPEN ARTFISH software application and its backbone OPEN ARTFISH database. The software application is built to estimate the total catch and value by species for sampling schemes of small-scale fisheries. Other major outputs of the OPEN ARTFISH are guidelines, manuals, training course and material.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
<b>14.4</b> <i>Restore fish stocks in the shortest time feasible</i>	<b>14.4.1</b> <b>Proportion of fish stocks within biologically sustainable levels</b>	FAO	Databanks	Fishery and Aquaculture Statistical Collections	FAO-Fisheries and Aquaculture Division	Statistical collections on fisheries and aquaculture.
				Sea around us	University of British Columbia	Provides fisheries and fisheries-related data at spatial scales that have ecological and policy relevance.
				WorldFish	WorldFish, CGIAR	Provides open-source data platforms to the research and development communities.
				Fishery Solutions Center	EDF	The only comprehensive online database of rights-based management programs, this tool allows visitors to search programs by keyword, world region, species, gear type and additional helpful terms.
			Datasets	Database on Port State Measures	FAO-Fisheries and Aquaculture Division	Provides access to port state measures (PSM) adopted by States to prevent, deter and eliminate IUU fishing.

<b>SDG Goal</b>	<b>SDG indicator</b>	<b>Agencies</b>	<b>Databases</b>		<b>Custodian agency</b>	<b>Description</b>
				Global Capture Production	FAO-Fisheries and Aquaculture Division	Provides capture production statistics by country or territory, species item, and FAO Major Fishing Area.
			Methodologies	ARTFISH	FAO-Fisheries and Aquaculture Division	A standardized tool adaptable to most fisheries in the developing countries.
				OPEN ARTFISH	FAO-Fisheries and Aquaculture Division	Provides approaches, rules and techniques for fisheries statistical monitoring.
				FishStatJ	FAO-Fisheries and Aquaculture Division	Datasets on production, trade and consumption.



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## Target 14.5 Conserve 10% of coastal and marine areas

**Target 14.5** By 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information

**Indicator 14.5.1** Coverage of protected areas in relation to marine areas

Custodian agency: UNEP and its World Conservation Monitoring Centre

Partner agency: RAMSAR Convention on Wetlands

Nominally, Marine Protected Areas (MPA) comprise approximately 7.4% of the ocean, including 17.2% of national waters and 1.18% of the high seas, but the MPA in practice is probably much smaller. Effective design, site selection, monitoring and enforcement of MPAs remain a challenge. People can be negatively impacted when MPAs displace fishing, causing short-term impacts to livelihoods.

### (1) Databanks

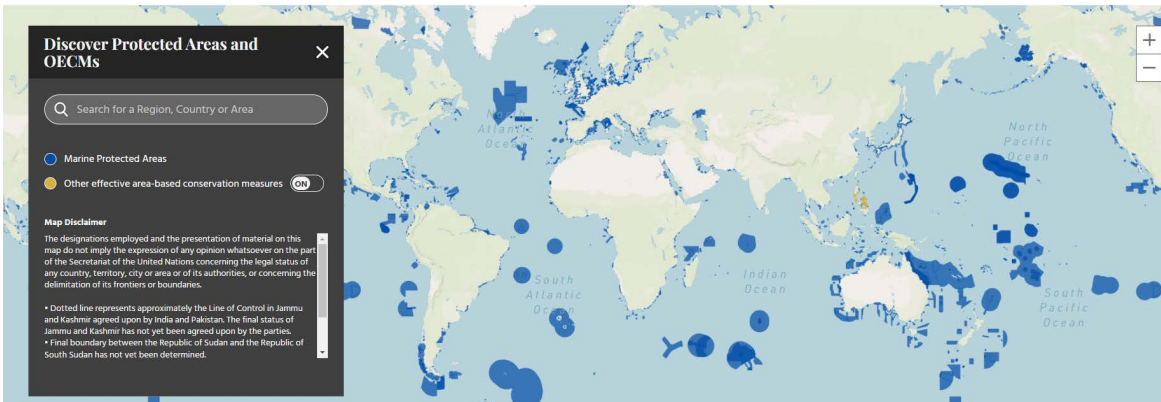
#### 1) *World Database on Protected Areas (WDPA)/Protected Planet*

(<https://www.protectedplanet.net/en>)

Protected Planet is the authoritative source of data on protected areas and other effective area-based conservation measures (OECMs). It exists due to the extensive efforts of governments and other stakeholders to map, monitor and report data on protected areas and OECMs. Through the Protected Planet website, users can explore the WDPA, World Database on OECMs, Global Database on Protected Area Management Effectiveness (GD-PAME), and a wealth of associated information. Users can start by exploring the interactive maps on the home page, or any of Protected Planet's nine thematic areas. Protected Planet enables a spectrum of users to access data for information-based decision making, policy development, and business and conservation planning. The goals of Protected Planet include but are not limited to informing decision-making and enhancing action; serving as a global platform for communication, exchange, acquisition and analysis of knowledge and data on the status and trends of protected

areas; providing the world's policymakers with the most accurate information on protected areas and their value for conserving biodiversity and ecosystem services and supporting human communities.

Protected Planet also provides the basis for monitoring and reporting on progress towards international environmental targets. Every two years, UNEP-WCMC releases the Protected Planet Report on the status of the world's protected areas, with recommendations on how to meet international goals and targets.

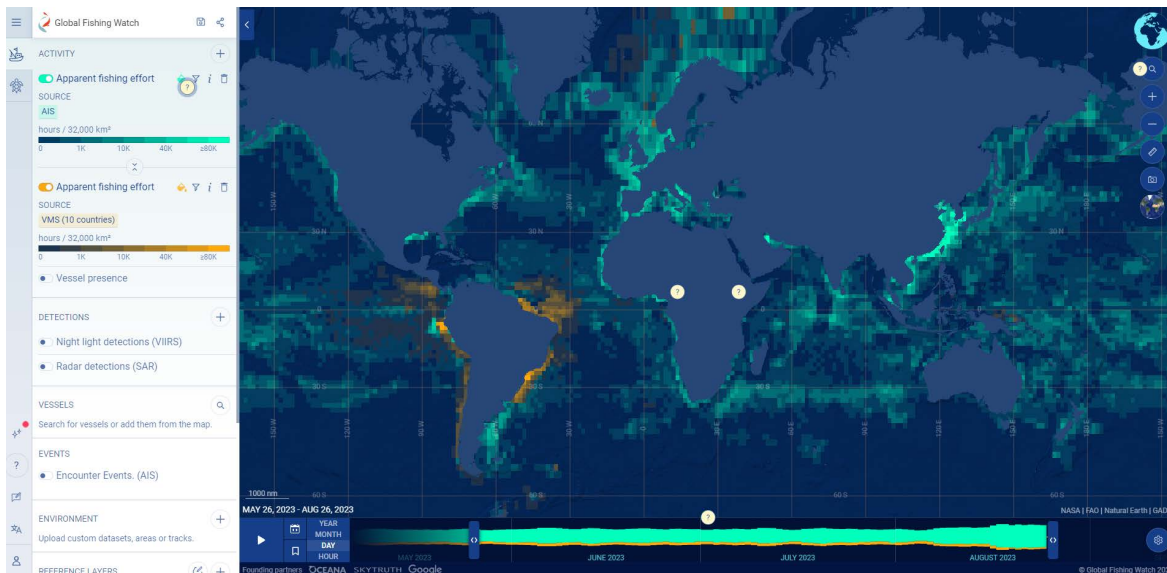


The Protected Planet website

## ***2) Global Fishing Watch/ Marine Management Portal***

(<https://globalfishingwatch.org/map/marine-manager?latitude=19&longitude=26&zoom=1.5>)

Global Fishing Watch is harnessing the data and technology revolution to support the effective design, management and monitoring of MPAs. The marine manager portal makes diverse ocean datasets accessible and translates them into actionable information to support decision-making. It empowers managers to rapidly collate, assess and analyze scientific data integral to the governance of MPAs. The data from the platform could be used to assess the effectiveness of MPAs, determine priority areas for protection in waters beyond national jurisdiction and better understand the response of industrial fishing fees to large marine protected areas.



### Global Fishing Watch Portal

#### 3) **Natura 2000** ([https://ec.europa.eu/environment/nature/natura2000/index\\_en.htm](https://ec.europa.eu/environment/nature/natura2000/index_en.htm))

Natura 2000 is a network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types. It stretches across all 27 EU countries, both on land and at sea. The aim of the network is to ensure the long-term survival of Europe's most valuable and threatened species and habitats listed under both the Birds Directive and the Habitats Directive.

The Natura 2000 Viewer is an online tool that presents all Natura 2000 sites. It provides key information on designated species and habitats, data on population sizes and information on conservation status. The viewer can be used for general purposes or for more specific searches.

#### **(2) Methodologies**

##### 1) **European Maritime Spatial Planning Platform** ([https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2014.257.01.0135.01.ENG](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.257.01.0135.01.ENG))

The European Maritime Spatial Planning Platform is a service for Member States to share relevant knowledge and experiences designed to offer support with the implementation of Maritime Spatial Planning (MSP). With the adoption of the EU

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Directive on Maritime Spatial Planning (2014/89/EU), all coastal EU Member States are required to prepare cross-sectoral maritime spatial plans by 2021. The European MSP Platform is an information and communication gateway designed to support all EU Member States in their efforts to implement MSP in the years to come.

2) **Marxan** (<https://marxansolutions.org/>)

Marxan is a suite of tools designed to help decision makers find good solutions to conservation planning problems. This includes free software that can be used to solve several types of planning problems and extensive documentation and examples describing a framework for approaching conservation planning. Marxan is the most frequently used conservation planning software and has been applied to hundreds of spatial conservation planning problems around the world.

<b>SDG Goal</b>	<b>SDG indicator</b>	<b>Agencies</b>	<b>Databases</b>		<b>Custodian agency</b>	<b>Description</b>
<b>14.5</b> <i>Conserve 10% of coastal and marine areas</i>	<b>14.5.1</b> <b>Coverage of protected areas in relation to marine areas</b>	UNEP and its World Conservation Monitoring Centre, Ramsar Convention on Wetlands	Databanks	WDPA/Protected Planet	UNEP World Conservation Monitoring Centre (UNEP-WCMC)	The World Database on Protected Areas (WDPA) is the most comprehensive global database on protected areas and other effective area-based conservation measures (OECMs).
				Global Fishing Watch/ Marine Manager Portal	Global Fishing Watch	The portal makes diverse ocean datasets accessible and translates them into actionable information to support decision-making.
				Natura 2000	Directorate-General for Environment, European Commission	Natura 2000 is a network of core breeding and resting sites for rare and threatened species and some rare natural habitat types, both on land and at sea.
			Methodologies	European Maritime Spatial Planning Platform	European Parliament, Council of the European Union	Document establishing a framework for maritime spatial planning
				Marxan	The Marxan Advisory committee	Marxan is a suite of tools designed to help decision makers find good solutions to conservation planning problems.

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**Target 14.6 Prohibit certain forms of fisheries subsidies that contribute to overcapacity and overfishing**

**Target 14.6** By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to IUU fishing, and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation

**Indicator 14.6.1** Progress by countries in the degree of implementation of international instruments aiming to combat IUU fishing.

**Custodian agency:** FAO

Fisheries are a key source of protein and livelihoods for the millions in coastal communities, who are powerless by themselves to tackle the heavily subsidized industrial fishing boats and the overfishing that these involve (Sakai, 2017; Sumaila et al., 2019). To reach an agreement all fishery countries must determine their commitment to the international subsidy plan.

**(1) Methodologies**

**1) *A Fisheries Subsidies Guide*** (<https://www.fao.org/3/y4446e/y4446e0h.htm>)

The Guide has been developed to assist in studying fisheries subsidies. It aims at being an instrument for studies covering all different types of subsidies in all sectors of the fisheries industry and attempts to provide a flexible technical tool that can be used by those who prepare reports and studies on subsidies.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
<b>14.6</b> <i>Prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing</i>	<b>14.6.1 Progress by countries in the degree of implementation of international instruments aiming to combat IUU fishing.</b>	FAO	Methodologies	A Fisheries Subsidies Guide		The Guide is developed to assist in studying fisheries subsidies.

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## Target 14.7 Increase the economic benefits to SIDS and LDCs

**Target 14.7** By 2030, increase the economic benefits to SIDS and LDCs from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism.

**Indicator 14.7.1** Sustainable fisheries as a percentage of GDP in SIDS, LDCs and all countries

Custodian agency: FAO and UNEP-WCMC

Small-scale and artisanal fisheries are an essential component of the economies of small island developing States (SIDS) and least developed countries (LDCs). While fisheries form the basis for several core livelihoods, SIDS and LDCs often lack the financial, human, technical and other resources to benefit from the marine environment. Their susceptibility to climate change and natural disasters, as well as the high costs associated with transportation, infrastructure and administration, mean that they have a reduced opportunity to create economies of scale.

### (1) Databanks

1) ***FAOSTAT*** (<https://www.fao.org/faostat/zh/#home>)

FAOSTAT provides free access to food and agriculture data for over 245 countries and territories and covers all FAO regional groupings from 1961 to the most recent year available. The FAO is a specialized agency of the United Nations that leads international efforts to defeat hunger. Its goal is to achieve food security for all and make sure that people have regular access to enough high-quality food to lead active, healthy lives. With over 194 member states, FAO works in over 130 countries worldwide.

2) ***List of SIDS Sustainable Development Knowledge Platform***

(<https://sustainabledevelopment.un.org/topics/sids/list>)

The Barbados Programme of Action (BPOA), adopted in 1994 and further complemented by The Mauritius Strategy of Implementation (MSI) of 2005 and MSI+5



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Outcome document, recognizes that although they are afflicted by economic difficulties and confronted by development imperatives similar to those of developing countries generally, SIDS have their own peculiar vulnerabilities and characteristics. They are highlighted in “The Future We Want”, adopted at The United Nations Conference on Sustainable Development, known as Rio+20, that took place in Rio de Janeiro, Brazil, in June 2012. Their small size, remoteness, narrow resource and export base, and exposure to global environmental challenges and external economic shocks, including to a large range of impacts from climate change and potentially more frequent and intense natural disasters. SIDS continue to address these structural and external challenges to achieve their sustainable development.

Documents are listed by topic, including resolutions and decisions, summaries, outcome documents, Secretary-General reports, concept notes, technical support team issues briefs, provisional agenda, reports, meeting reports, programme, background papers/special studies, General Assembly official documents, journal, preparatory documents, meetings coverage, letters, other documents, press releases, presentations, partnership dialogues, pre-conference activities, logistics, additional resources, side events, and background notes.

## **(2) Methodologies**

### **1) Sustainable Fisheries as a Percentage of GDP by Region**

The indicator, expressed as a percentage of countries’ gross domestic product (GDP), is intended to measure the value of sustainable fisheries. Data will be produced for all countries and aggregated for SIDS and LDCs. The indicator will measure progress towards SDG Target 14.7. Along with other indicators under SDG 14, it will form a picture of marine activity giving countries intelligence on optimum levels of fishing, aquaculture expansion, and fair and secure access to living aquatic resources.

<b>SDG Goal</b>	<b>SDG indicator</b>	<b>Agencies</b>	<b>Databases</b>		<b>Custodian agency</b>	<b>Description</b>
<i>14.7 Increase the economic benefits to SIDS and LDCs</i>	<b>14.7.1 Sustainable fisheries as a percentage of GDP in SIDS, LDCs and all countries</b>	FAO and UNEP-WCMC	Databanks	FAOSTAT	FAO	FAOSTAT provides free access to food and agriculture data for over 245 countries and territories and covers all FAO regional groupings from 1961 to the most recent year available.
				List of SIDS Sustainable Development Knowledge Platform	UN-DSDG	Documents pertinent to SIDS listed by topic, including resolutions and decisions, summaries, and many others.
			Methodologies	Sustainable Fisheries as a Percentage of GDP by Region	FAO	The indicator is intended to measure the value of sustainable fisheries. It is expressed as a percentage of countries' GDP. Data will be produced for all countries and aggregated for SIDS and LDCs.

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## Target 14.A Increase scientific knowledge, develop research capacity and transfer marine technology

**Target 14.A** Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology in order to improve ocean health and enhance the contribution of marine biodiversity to the development of developing countries, in particular, SIDS and LDCs.

**Indicator 14.A.1** Proportion of total research budget allocated to marine technology research.

Custodian agency: IOC-UNESCO

Marine science is essential to good marine management, which can help to improve outcomes for the targets of SDG 14. Transfer of Marine Technology is important for ensuring the exploration and exploitation of the seabed and areas for developing countries to access benefits from oceans and seas (Harden-Davies, 2020). Innovation in marine technology is necessary to capitalize on ocean wealth in a sustainable manner.

### (1) Databanks

#### 1) ***Ocean Data and Information System (ODIS)*** (<https://catalogue.odis.org/>)

ODIS is an e-environment where users can discover data, data products, data services, information, information products and services provided by Member States, projects and other partners associated with IOC. IODE will work with existing stakeholders to improve the accessibility and interoperability of existing ocean data and information. It will contribute to the development of a global ocean data and information system ODIS.

## IOC Ocean Data and Information System

### "Catalogue of Sources"

The ODIS "**Catalogue of Sources**" aims to be an online browsable and searchable catalogue of existing ocean related web-based sources/systems of data and information as well as products and services. It will also provide information on products and visualize the landscape (entities and their connections) of ocean data and information sources.

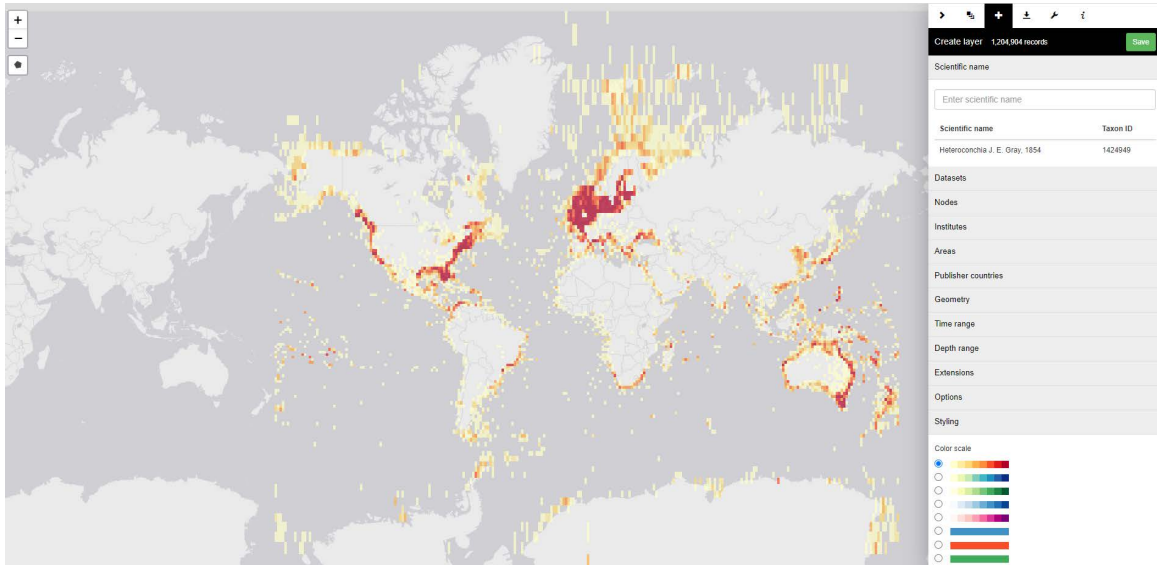
Click on one of the source types below or go to the [search page](#) to search in all types.

Bibliographic infobases (catalogues and repositories)	Code lists and vocabularies	Data catalogues	Data products (model output, forecasting, climatologies...)
Data systems/portals (allowing downloading of datasets)	Education and training materials	Information on platforms (buoys, sensors, floats, gliders, satellites...)	Information on experts and organizations
Information on projects	Information on vessels	Journals (open source and commercial)	Manuals, guidelines, standards and best practices
Maps and atlases (geospatial products)	Multimedia content	Real-time observing systems	Software (ocean related)

### IOC Ocean data and information system

#### **2) Ocean Biodiversity Information System (OBIS)** (<https://obis.org/>)

OBIS is a global open-access data and information clearing house on marine biodiversity for science, conservation and sustainable development. The Global Biodiversity Information Facility (GBIF) and the IOC-UNESCO OBIS has a collaboration agreement with the aim to improve the volume and quality of biodiversity information available to policymakers for conservation and sustainable use of the ocean's biological resources.



### The OBIS Data Portal

More than 20 OBIS nodes around the world connect 500 institutions from 56 countries. Collectively, they have provided over 45 million observations of nearly 120,000 marine species. The datasets are integrated, which allows searching and mapping by species name, higher taxonomic level, geographic area, depth, time and environmental parameters. OBIS emanates from the Census of Marine Life (2000-2010) and was adopted as a project under IOC-UNESCO's IODE programme in 2009.

### **3) International Ocean Discovery Program (IODP)** (<https://www.iodp.org/>)

IODP is an international marine research collaboration that explores Earth's history and dynamics using ocean-going research platforms to recover data recorded in seafloor sediments and rocks and to monitor subseafloor environments. These entities represent twenty-one nations whose scientists are selected to staff IODP research expeditions conducted throughout the world's oceans. The IODP website also provides links to other databanks such as Site Survey Data Bank (SSDB) and Micropaleontological Reference Centers (MRCs). IODP provides .pdf, .jpg, and .eps maps of drilled sites from all scientific ocean drilling programs through the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) Resolution Science Operator.

The IODP Science Support Office (SSO) for the International Ocean Discovery Program is provided by the Scripps Institution of Oceanography at the University of

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California San Diego under Cooperate Agreement OCE-1327683 with the National Science Foundation.

4) **ARGO** (<https://argo.ucsd.edu/>)

ARGO is an international program that collects information from the oceans using a fleet of robotic floats. There are many sources of ARGO data depending on the desired format, source and application. Data include gridded products provided by Argo and sometimes other sources, such as temperature, salinity, mixed layer depth, isothermal layer depth, mixed layer depth, curated profile collections, and velocity. Data are often in NetCDF format but can sometimes be found in other formats.

The array is made up of 30 different countries' contributions. The program, including the three missions, are overseen by an International Argo Steering Team (<https://argo.ucsd.edu/organization/argo-steering-team/>) and a Data Management Team (<http://www.argodatamgt.org/>) that are comprised of representatives of float-providing countries.

5) **Global Sea Level Observing System (GLOSS)** (<http://www.gloss-sealevel.org/>)

GLOSS uses a network of 290 sea level stations located around the world to measure global sea levels. GLOSS has been used to collect real-time measurements of sea levels since the 2004 Indian Ocean tsunami, and this information is used to support long-term climate change studies.

GLOSS remains under the auspices of the IOC and is one of the observing components under the World Meteorological Organization (WMO)/ IOC JCOMM. The success of the GLOSS program depends on the voluntary participation of countries and national bodies. The IOC focuses on coordinating the resources and efforts of the participants on a global scale.

6) **World Ocean Database (WOD)** (<https://www.ncei.noaa.gov/products/world-ocean-database>)

WOD is the world's largest collection of uniformly formatted, quality controlled, publicly available ocean profile data. It is a powerful tool for oceanographic, climatic, and environmental research, and the end result of more than 20 years of coordinated efforts to

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incorporate data from institutions, agencies, individual researchers, and data recovery initiatives into a single database. WOD data spans from Captain Cook's 1772 voyage to the contemporary Argo period, making it a valuable resource for long term and historical ocean climate analysis. Original versions of the 20,000+ datasets in the WOD are available through the NCEI archives. WOD provide multiple datasets about OSD (Bottle, low resolution CTD and XCTD, and plankton data), MBT (Mechanical Bathythermograph data), XBT (Expendable Bathythermograph data), CTD (High resolution CTD data), APB (Autonomous Pinniped Bathythermograph data), DRB (Drifting Buoy data), MRB (Moored Buoy data), PFL (Profiling Float data), UOR (Undulating Oceanographic Recorder data), GLD (Glider data), SUR (Surface data). The WOD consists of periodic major releases and quarterly updates. Each major release is associated with a concurrent release of the World Ocean Atlas (WOA) and contains final quality control flags used in the WOA, which includes a manual as well as automated steps. Each quarterly update release includes additional historical and recent data and preliminary quality control. The 2018 release of the World Ocean Database (WOD18) included more than 15.7 million oceanographic casts made up of 3.56 billion individual profile measurements.

**7) *The Oceanographic Data Center at the Chinese Academy of Sciences (CASODC)***

(<http://english.casodc.com/>)

CASODC was founded in May 2018 to address the needs of marine scientific and technological innovations, policies and resource management as well as oceanic industries and economic development. The CASODC is supported by the Institute of Oceanology at the Chinese Academy of Sciences (IOCAS) and the Center for Ocean Mega-Science at the Chinese Academy of Sciences (COMS). It has constructed a data resource pool covering a wide range of disciplines, multi-temporal and spatial scales, including data from independent acquisition, international sharing, remote sensing and modeling, and others. Data from 63 sets of western Pacific subsurface moorings, 29 sets of Chinese coastal floating buoys and 453 investigative voyages have been collected and compiled. An interactive visualization system, CASEarth-Ocean, was established based on multi-source marine scientific data. Currently, the system has 13 functional modules, including global climate change. CASODC has formed an operative service system integrating data

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management, online analysis, visualization and decision support to provide high quality services for marine scientific and technological innovations.

**8) PANGAEA** (<https://www.pangaea.de/>)

The information system PANGAEA is operated as an open access library aimed at archiving, publishing and distributing georeferenced data from earth system research. The system guarantees long-term availability of its content through a commitment of the hosting institutions. Most of the data are freely available and can be used under the terms of the license mentioned on the data set description. The description of each data set is always visible and includes the principal investigator (PI) who may be asked for access. Each dataset can be identified, shared, published and cited by using a DOI Name. Archived data are machine readable and mirrored into the PANGAEA data warehouse which allows efficient compilations of data. PANGAEA is open to any project, institution, or individual scientist to use or to archive and publish data.

**9) CASEarth** (<https://data.casearth.cn/en/>)

The portal is specifically designed to support the implementation of SDGs, including SDG14, by releasing and sharing data from the "Big Earth Data Science Engineering Project (CASEarth)". CASEarth was launched by the Chinese Academy of Sciences. The portal provides a variety of data mining models, such as item classification, keyword search, tag cloud filtering, and data association rules. Additionally, it facilitates data acquisition via online downloading and API access.

**(2) Datasets**

**1) Ocean Color Web**

(<https://oceancolor.gsfc.nasa.gov/cgi/browse.pl?sub=level3&per=8D&day=18956&set=10&ndx=0&mon=18901&sen=amod&rad=0&frc=0&dnm=D@M&prm=CHL>)

NASA's Ocean Color Web provides the global chlorophyll concentration and SST satellite data product, with their available datasets including SeaWiFS data, MODIS-Aqua and MODIS-Terra data. Ocean Color Web is supported by NASA's Ocean Biology Processing Group (OBPG) at NASA's Goddard Space Flight Center. As a Science Investigator-led Processing System (SIPS), OBPG supports the collection, processing,



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calibration, validation, archive and distribution of ocean-related products from a number of missions which are supported within the framework and facilities of the NASA Ocean Data Processing System (ODPS), which has been successfully supporting operational, satellite-based remote-sensing missions since 1996. The group's capabilities continue to evolve and expand to meet the demands and challenges of future missions.

**2) *Ocean<sup>+</sup> Library*** (<https://library.oceanplus.org/metadata>)

Ocean<sup>+</sup> Library provides a list of more than 180 known datasets, databases, and data portals containing marine and coastal data and information about biodiversity.

**3) *ORAS5 Global Ocean Reanalysis***

(<https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-oras5?tab=overview>)

This dataset provides global ocean and sea-ice reanalysis (Ocean Reanalysis System 5, ORAS5), with monthly mean data prepared by the European Centre for Medium-Range Weather Forecasts (ECMWF) OCEAN5 ocean analysis-reanalysis system. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset. The reanalysis provides information without temporal and spatial gaps.

**4) *The Environmental Research Division's Data Access Program (ERDDAP)***

(<https://www.ncei.noaa.gov/erddap/index.html>)

ERDDAP is free and open source that provides a simple, consistent way to download subsets of scientific datasets in common file formats and make graphs and maps. Oceanographic data available on ERDDAP include data from satellites and buoys. ERDDAP standardizes the different types of data from various remote data servers and offers a consistent way for users to search for datasets of interest. So far, 157 datasets are available on the website, including datasets of primary productivity, marine organisms, SST, precipitation, USM AMSEAS Dynamic Anomaly Properties, and more.

**(3) Methodologies**

**1) *UNEP Document Repository*** (<https://wedocs.unep.org/>)

The repository allows for research of many methodological files and publications pertinent to different ocean programs.

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## **2) IOC Criteria and Guidelines on the Transfer of Marine Technology**

(<https://repository.oceanbestpractices.org/handle/11329/856>)

The IOC criteria and guidelines on the transfer of marine technology aim at applying the provisions of Part XIV (Development and transfer of marine technology) of the United Nations Convention on the Law of the Sea (UNCLOS), providing a critical tool to promote capacity building in ocean and coastal related matters through international cooperation.

### **(4) International Scientific Programs**

#### **1) The Global Ocean Observing System (GOOS)** (<https://ioc.unesco.org/our-work/global-ocean-observing-system-goos>)

The GOOS is an IOC-UNESCO organization that focuses on the collaboration of data collection efforts and the work of international experts. It also has a capacity-building aspect, so that countries can join data collection activities. Created in March 1991 as an initiative of the IOC, GOOS adopted the Framework for Ocean Observing (FOO) as its foundational document. As an integrated and sustained ocean observing system, it was created to meet the needs of many nations and deliver maximum impact for the user base and society. This system is designed to be flexible, adapting to evolving scientific, technological, and societal demands, which makes it fit-for-purpose by ensuring that data flow on Essential Ocean Variables (EOVs), and information services and applications actually do benefit end users.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
<b>14.A</b> <i>Increase scientific knowledge, develop research capacity and transfer marine technology</i>	<b>14.A.1</b> <b>Proportion of total research budget allocated to marine technology research.</b>	IOC-UNESCO	Databanks	ODIS	IOC	The IOC Ocean Data and Information System (ODIS) is an e-environment where users can discover data, data products, data services, information, information products and services provided by Member States, projects and other partners associated with IOC.
				OBIS	IOC-UNESCO	OBIS is a global open-access data and information clearing-house on marine biodiversity for science, conservation and sustainable development.
				IODP	Scripps Institution of Oceanography at the University of California San Diego	IODP is an international marine research collaboration that explores Earth's history and dynamics using ocean-going research platforms to recover data recorded in seafloor sediments and rocks and to monitor subseafloor environments.
				ARGO	International Argo Steering Team and Data Management Team	ARGO is an international program that collects information from the oceans using a fleet of robotic instruments that drift with currents and rise and fall between the surface and a mid-water level.

<b>SDG Goal</b>	<b>SDG indicator</b>	<b>Agencies</b>	<b>Databases</b>	<b>Custodian agency</b>	<b>Description</b>
			GLOSS	IOC, WMO, JCOMM	GLOSS uses a network of 290 sea level stations located around the world to measure global sea levels.
			WOD	NCEI	WOD is the world's largest collection of uniformly formatted, quality controlled, publicly available ocean profile data.
			CASODC	IOCAS and COMS	CASODC has constructed a data resource pool covering a wide range of disciplines, multi-temporal and spatial scales, including data from independent acquisition, international sharing, remote sensing and modeling, among others.
			PANGAEA	The European Commission	The information system PANGAEA is operated as an open access library aimed at archiving, publishing and distributing georeferenced data from earth system research.
			CASEarth	Chinese Academy of Sciences	The portal releases and shares data from the "Big Earth Data Science Engineering Project (CASEarth)", provides a variety of data mining models, and facilitates data acquisition via online downloading and API access.

SDG Goal	SDG indicator	Agencies	Databases	Custodian agency	Description
			Ocean Color Web	NASA's OBPG	NASA's Ocean Color Web provides the global chlorophyll concentration and SST satellite data product. Their available datasets include SeaWiFS data, MODIS-Aqua and MODIS-Terra data.
			Ocean <sup>+</sup> Library		Ocean <sup>+</sup> Library provides a list of more than 180 known datasets, databases, and data portals containing marine and coastal data and information about biodiversity.
			ORAS5	ECMWF	This dataset provides global ocean and sea-ice reanalysis (ORAS5: Ocean Reanalysis System 5), with monthly mean data prepared by the European Centre for Medium-Range Weather Forecasts (ECMWF) OCEAN5 ocean analysis-reanalysis system.
			ERDDAP	NOAA	ERDDAP is a free and open source that provides a simple, consistent way to download subsets of scientific datasets in common file formats and make graphs and maps.
			Methodologies	UNEP Document Repository	Provides quick research for many methodological files from different ocean programs
				IOC Criteria and	The IOC criteria and guidelines on the transfer of marine technology introduces the

<b>SDG Goal</b>	<b>SDG indicator</b>	<b>Agencies</b>	<b>Databases</b>		<b>Custodian agency</b>	<b>Description</b>
				Guidelines on the Transfer of Marine Technology		detailed knowledge on marine technology transfer regulation and recommendation between its members. The guidelines helped in promoting the technology communication between the members.
			International Scientific Programs	GOOS	IOC-UNESCO	The Global Ocean Observing System is an IOC-UNESCO organization that focuses on collaboration of data collection efforts and international experts.

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## Target 14.B Provide access to markets and marine resources for small-scale fishers

**Target 14.B** Provide access for small-scale artisanal fishers to marine resources and markets.

**Indicator 14.B.1** Progress by countries in the degree of application of a legal/regulatory/ policy/ institutional framework which recognizes and protects access rights for small-scale fisheries.

**Custodian agency:** FAO

The development and expansion of global fisheries has led to overfishing of major stocks and widespread habitat destruction. The problem includes both large- and small-scale fishing. Approximately 120 million people work directly in commercial capture fisheries, most from developing countries, working in small scale-fisheries (United Nations Ocean Conference, 2017). Small-scale fishing communities are often ignored in decision-making surrounding regulatory actions, even when they have conflicts with other sectors such as tourism and agriculture.

### 1) ***ICSF- International Collective in Support of Fishworkers*** (<https://www.icsf.net/>)

The International Collective in Support of Fishworkers (ICSF) draws its mandate from the historic International Conference of Fishworkers and their Supporters (ICFWS), held in Rome in 1984, parallel to the World Conference on Fisheries Management and Development organized by FAO. ICSF is an international non-governmental organization that works towards the establishment of equitable, gender-just, self-reliant and sustainable fisheries, particularly in the small-scale, artisanal sector.

<b>SDG Goal</b>	<b>SDG indicator</b>	<b>Agencies</b>	<b>Databases</b>		<b>Custodian agency</b>	<b>Description</b>
<b>14.B</b> <i>Provide access for small-scale artisanal fishers to marine resources and markets</i>	<b>14.B.1 Progress by countries in the degree of application of a legal/regulatory/ policy/ institutional framework which recognizes and protects access rights for small-scale fisheries</b>	FAO	Databanks	ICSF-International Collective in Support of Fishworkers	ICFWS, FAO	ICSF is an international non-governmental organization that works towards the establishment of equitable, gender-just, self-reliant and sustainable fisheries, particularly in the small-scale, artisanal sector.



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## Target 14.C Implement international law on the conservation and sustainable use of oceans and their resources

**Target 14.C** Implement international law on the conservation and sustainable use of oceans and their resources

**Indicator 14.C.1** Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the UNCLOS, for the conservation and sustainable use of the oceans and their resources

Custodian agency: UN Division for Ocean Affairs and the Law of the Sea (DOALOS), FAO, UNEP, International Labour Organization (ILO) and UN-Oceans agencies

Support agency: IOC-UNESCO

UNCLOS lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources. It enshrines the notion that all problems of ocean space are closely interrelated and need to be addressed as a whole.

### **(1) Databank**

#### **1) Maritime Space: Maritime Zones and Maritime Delimitation**

(<https://www.un.org/Depts/los/LEGISLATIONANDTREATIES/index.htm>)

Maritime Zones and Maritime Delimitation web was prepared to provide comprehensive information on (i) the deposits with the Secretary-General of the United Nations, pursuant to the United Nations Convention on the Law of the Sea, of charts or the lists of geographical coordinates of points, specifying the geodetic datum, in relation to straight baselines and archipelagic baselines as well as the outer limits of the territorial sea, the exclusive economic zone and the continental shelf; (ii) the discharge of obligations of

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due publicity to all laws and regulations adopted by the coastal State relating to innocent passage through the territorial sea and all laws and regulations adopted by States bordering straits relating to transit passage through straits used for international navigation, as well as concerning due publicity given by coastal States, in accordance with the Convention, to the temporary suspension of innocent passage of foreign ships in specified areas of the territorial sea; and (iii) the status of State practice containing the national legislation of coastal States and treaties dealing with the delimitation of maritime boundaries. The site also contains other reference material, such as tables indicating the status of the United Nations Convention on the Law of the Sea, summary of national claims to maritime jurisdiction, etc.

National legislation, treaties on the delimitation of maritime boundaries and other relevant information contained in this Internet publication were obtained from Governments, as well as on occasion from other reliable sources with a view to ensure the most accurate representation of the current status. Most of the information has already been published in the Law of the Sea Bulletin, a periodic publication of the Division or in other Law of the Sea publications issued to date. The present web site has been prepared by the Division for Ocean Affairs and the Law of the Sea (DOALOS), Office of Legal Affairs and United Nations Secretariat.

SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
<i>14.C Implement international law on the conservation and sustainable use of oceans and their resources</i>	<b>14.C.1 Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the UNCLOS, for the conservation and sustainable</b>	DOALOS, FAO, UNEP, International Labour Organization (ILO) and UN-Oceans agencies.	Databank	Maritime Space: Maritime Zones and Maritime Delimitation	DOALOS	The site provides comprehensive information related to maritime space.

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SDG Goal	SDG indicator	Agencies	Databases		Custodian agency	Description
	use of the oceans and their resources					

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### 3. Gaps and Recommendations

Oceans account for approximately two-thirds of the Earth's surface, with an average water depth of more than 3,800 m, playing a vital role in the global climate system and biosphere, providing crucial resources for humanity, including food, water, energy, and minerals. To safeguard this critical ecosystem and the goods and services it provisions, ocean system changes at various scales must be predicted. This largely depends on the multidisciplinary, long-term continuous, real-time or near-real-time, comprehensive three-dimensional observation of the global ocean. However, as oceanographic data is diverse in its sources, types, temporal and spatial scales, and given the lack of internationally unified data open-sharing policies, the development of ocean database and data mining platforms has been quite limited (Lin and Yang, 2020). Moreover, the temporal and spatial resolution of marine scientific data up to now can hardly meet needs of the management of marine affairs (Levin et al., 2019). Given the vast dimensions and complexity of ocean data, an efficient ocean database must be a concerted combined effort on both regional and global scale (Anderson et al., 2019; Schmidt et al., 2019). Here, recommendations from the aspects of data acquisition, database management, data service, data development and utilization have been listed to cope with the current dilemma with the ocean data platform and support implementation of the recent calls for action necessary for achieving SDGs.

#### 3.1 Data Acquisition—Advance and optimize the global ocean observing system

➤ **Enhance the use of integrated technologies for data acquisition and monitoring**

- Facilitate a governance approach that integrates observational capabilities under the framework of GOOS (e.g., Moltmann et al., 2019) across different scales in pace and time, various platforms and disciplines.
- Explore advanced technology for ocean observation, e.g., blockchain and intelligent technologies, the Global Navigation Satellite System (GNSS), Continuously Operating Reference Stations (CORS), omics approaches, image recognition, and ultra-deep hydrographic measurements.
- Develop cost-effective strategies and accelerate the infusion of technology to advance sensors, platforms, and networks. Expand the application of multi-disciplinary sensors

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and multi-platform *in situ* observation equipment, such as real-time submarines and buoys, autonomous underwater vehicles (AUV) and underwater gliders.

➤ **Expand the spatiotemporal coverage and resolution of ocean observation data**

- Coordinate the collection of multidisciplinary and sustained ocean data and acquire comprehensive marine environmental information with full-depth and high spatiotemporal resolution, stressing EOVs.
- Reduce capability gaps, through improvements of coverage and sampling in space and time, measurement accuracies, and measurements of critical but under-measured observables (e.g., air-sea fluxes and ocean surface currents, ecosystem health and biodiversity in deep ocean as well as coastal areas).
- Address data paucity, particularly related to topics of increasing interest and mounting priorities to Member States.
- Sustain the observation of EOVs for operational applications, including conservation and sustainable development, scientific research, and the assembling of climate data records.

### **3.2 Ocean Database Management—Organization and management framework of database**

➤ **Framework of database**

- Formulate international policies for ocean data sharing and management and provide guidance for the policymaking of regional and thematic ocean database systems.
- Arouse the strength of countries and relevant international initiatives to build a comprehensive data resource database at the regional/global level, address ecologically sensitive regions, and establish thematic databases for coastal and submesoscale marine ecosystems.
- Fulfill the essential needs of the key marine scientific and sociological studies, e.g., multi-scale ocean-atmosphere interaction and climate change, the mechanism and prediction of marine multi-scale dynamics variation, and the deep-sea biogeochemical cycle process.

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➤ **Data preservation and management**

- Enhance data and information curation and delivery and perform quality assurance, quality control and standardization of the raw data during the data collection and submission to build an international, collaborative, and multidisciplinary community of practice that jointly collects and shares global observations on EOVs for measuring change accurately and reliably.
- Integrate and assimilate the multi-source ocean big data to achieve consistency and comparability across data sources.
- Reinforce trans-regional capacity-building through partnerships and knowledge sharing, and adopt a comprehensive data management framework, including the consistent and sustained use of data repositories, implementing linkages between them.

**3.3 Data Service--Strengthen capacity building and improve service quality**

➤ **Capacity building**

- Foster training to establish an interdisciplinary and interdisciplinary personnel team according to the requirements of an ocean database.
- Enhance capacity building and knowledge integration across the ocean observing value chain, from data collection to the generation of information and its applications.

➤ **Advance data accessibility**

- Engage a wider group of stakeholders, including indigenous groups and the general public, to develop baseline data estimates using traditional knowledge and citizen-science initiatives.
- Improve the link between users and observing systems, such as GOOS and FAO, and other governmental and academic entities.
- Improve and facilitate access of ocean data and metadata and formulate open data policies on the premise of protecting the intellectual property rights of data producers.

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- Innovate data and information services and relevant educational resources to support diverse user needs across different regions and sectors, to promote data utilization efficiency and to meet the challenges of Big Data and distributed data systems.
  - Foster international collaborations and coordination, including free and public data access (real-time or near real-time where applicable), sharing of resources, coordination of education and outreach, and management of a shared and responsible governance system that provides funds for these activities.

### **3.4 Data Development and Utilization—Explore utilization methods and establish an analysis platform for ocean data**

#### **➤ Operational system**

- Improve network service capability and technology, create various data access and conversion tools, and promote open access and data visualization.
- Reinforce the development of online data mining platforms and open-source tools, design the cross-repository search tools, enhance data interoperability, and develop ocean big data analysis platforms supporting data upload and in-depth analysis.
- Carry out multi-unit and multi-system linkage analysis to promote coupled ocean-atmosphere analysis, land-ocean interaction analysis, etc.

#### **➤ Prediction, assessment, and decision-making support system**

- Incorporate model and satellite products and data-assimilation models into ocean dynamical forecasting systems and establish ecological monitoring, forecasting, and accessing models for regional case studies.
- Provide services for the prediction and assessment of oceanographic phenomena and generate and release decision-making reports regularly to support governments in planning and adapting to a changing marine environment.



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## ABBREVIATION LIST

AADC	-- Australian Antarctic Data Centre
ANT	-- Antarctic Sciences
ARC	-- Arctic Sciences
Arctic ROOS	-- Arctic Ocean and Southern Ocean observing systems
ARGO	-- Array for Real-time Geostrophic Oceanography
ARGO	-- Array for Real-time Geostrophic Oceanography
ARTFISH	-- Approaches, Rules and Techniques for Fisheries Statistical Monitoring
AtlantOS	-- Integrated Atlantic Ocean Observing Systems
AUV	-- Autonomous Underwater Vehicles
AWI	-- Alfred Wegener Institute
BCO-DMO	-- Biological and Chemical Oceanography Data Management Office
BMDC	-- Beheerseenheid Mathematisch Model Noordzee en Schelde-estuarium and Belgisch Marien Datacentrum
BODC	-- British Oceanographic Data Centre
BPOA	-- Barbados Programme of Action
CASODC	-- Oceanographic Data Center at the Chinese Academy of Sciences
CECAF	-- Fishery Committee for the Eastern Central Atlantic
Cefas	-- Centre for Environment, Fisheries and Agriculture Science
CGIAR	-- One Constructive Group on International Agricultural Research
COMS	-- Center for Ocean Mega-Science at the Chinese Academy of Sciences
CORS	-- Continuously Operating Reference Stations
DACs	-- Data Assembly Centers

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DG MARE	-- Directorate-General for Maritime Affairs and Fisheries
DIVA	-- Data-Interpolating Variation Analysis
DOALOS	-- Division for Ocean Affairs and the Law of the Sea
DOI	-- Digital Object Identifier
ECMWF	-- European Centre for Medium-Range Weather Forecasts
EDF	-- Environmental Defense Fund
EMODnet	-- European Marine Observation and Data Network
EOS	-- Earth Observing System
EOVs	-- Essential Ocean Variables
ERDDAP	-- Environmental Research Division's Data Access Program
ERS	-- European Remote Sensing
ESA	-- European Space Agency
ESSD	-- Earth System Science Data
FAO	-- Food and Agriculture Organization
FAO	-- Food and Agriculture Organization
FIRMS	-- Fisheries and Resources Monitoring System
FishStatJ	-- Software for Fishery and Aquaculture Statistical Time Series
FOO	-- Framework for Ocean Observing
FSC	-- Fishery Solutions Center
GBIF	-- Global Biodiversity Information Facility
GDP	-- Gross Domestic Product
GD-PAME	-- Global Database on Protected Area Management Effectiveness
GEO	-- Geosciences Directorate
GFCM	-- General Fisheries Commission for the Mediterranean

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GHRSSST	-- Group for High Resolution Sea Surface Temperature
GLODAP	-- Global Ocean Data Analysis Project
GLOSS	-- Global Sea Level Observing System
GMW	-- Global Mangrove Watch
GNSS	-- Global Navigation Satellite System
GOA-ON	-- Global Ocean Acidification Observing Network
GOOS	-- Global Ocean Observation System
GOSHIP	-- Global Ocean Ship-Based Hydrographic Investigation Program
GSDA	-- Global Surface Drifter Array
GTA	-- Global Tuna Atlas
GTMBA	-- Global Tropical Moored Buoy Array
HAEDAT	-- Harmful Algal Event Database
HAIS	-- Harmful Algal Information system
HELCOM	-- Helsinki Commission
IAEA	-- International Atomic Energy Agency
ICEP	-- Index of Coastal Eutrophication
ICES	-- International Council for the Exploration of the Sea
ICOS	-- Integrated Carbon Observation System
ICSF	-- International Collective in Support of Fishworkers
ICSU	-- International Council for Science
ICSWS	-- International Conference of Fishworkers and their Supporters
ILO	-- International Labour Organization
INDEEP	-- International Network for Scientific Investigation of Deep-sea Ecosystems

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IndOOS	-- Indian Ocean Observing System
IOC	-- Intergovernmental Oceanographic Commission
IOCAS	-- Institute of Oceanology, Chinese Academy of Sciences
IOCOADS	-- International Comprehensive Ocean-Atmosphere Data Set
IODE	-- International Oceanographic Data and Information Exchange
IODP	-- International Ocean Discovery Program
ISSCAAP	-- International Standard Statistical Classification of Aquatic Animals and Plants
IUCN	-- International Union for Conservation of Nature
IWMI	-- International Water Management Institute
JAXA	-- Japan Aerospace Exploration Agency
JCOMM	-- Joint Technical Commission for Oceanography and Marine Meteorology
JeDI	-- Jellyfish Database Initiative
JGOFS	-- Joint Global Ocean Flux Study
JOIDES	-- Joint Oceanographic Institutions for Deep Earth Sampling
LDCs	-- Least Developed Countries
LSID	-- Life Science Identifiers
MARUM	-- Center for Marine Environmental Sciences at the University of Bremen
MPA	-- Marine Protected Areas
MRCs	-- Micropaleontological Reference Centers
MSI	-- Mauritius Strategy of Implementation
MSP	-- Maritime Spatial Planning
NASA	-- National Aeronautics and Space Administration

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NCEAS	-- The National Center for Ecological Analysis and Synthesis
NEEA/ASSETS	-- National Estuarine Eutrophication Assessment/ASSESSment of Estuarine Trophic Status
NSF	-- National Science Foundation
OADS	-- Ocean Acidification Data Stewardship
OA-ICC	-- Ocean Acidification International Coordination Centre
OAP	-- NOAA's Ocean Acidification Program
OBIS	-- Ocean Biodiversity Information System
OBPG	-- Ocean Biology Processing Group
OCE	-- Ocean Sciences
ODIS	-- Ocean Data and Information System
ODPS	-- Ocean Data Processing System
OECMs	-- Other Effective area-based Conservation Measures
OHI	-- Ocean Health Index
OPEN ARTFISH	-- Open Approaches, Rules and Techniques for Fisheries Statistical Monitoring
PI	-- Principal Investigator
PICES	-- North Pacific Marine Science Organization
PISCES	-- Pelagic Interactions Scheme for Carbon and Ecosystem Studies
PLC	-- Compilation of Pollution Load data
PLR	-- Polar Programs
PSM	-- Port State Measures
RECOFI	-- Regional Commission for Fisheries
SEA	-- Sea Education Association

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SIDS	-- Small Island Developing States
SIPS	-- Science Investigator-led Processing System
SOCAT	-- Surface Ocean CO <sub>2</sub> Atlas
SOLAS	-- International Convention for the Safety of Life at Sea
SPCAT	-- Surface Ocean CO <sub>2</sub> Atlas
SPURS	-- Salinity Processes in the upper-Ocean Regional Study
SSDB	-- Site Survey Data Bank
SSO	-- Science Support Office
TAOS	-- Tropical Atlantic Observing System
TPOS	-- Tropical Pacific Observing System
UCSB	-- University of California at Santa Barbara
UNCLOS	-- United Nations Convention on the Law of the Sea
UNCLOS	-- United Nations Convention on the Law of the Sea
UNEP	-- UN Environment Programme
UNEP-WCMC	-- UN Environment Programme World Conservation Monitoring Centre
US GLOBEC	-- US GLOBal Ocean Ecosystems Dynamics
VGPM	-- Vertically Generalized Production Model
VOS	-- Voluntary Observing Ship Program
WDCs	-- World Data Centers
WDPA	-- World Database on Protected Areas
WMO	-- World Meteorological Organization
WOA	-- World Ocean Atlas
WOCE	-- World Ocean Circulation Experiment

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WOD	-- World Ocean Database
WOD18	-- 2018 release of the World Ocean Database
WoRDSS	-- World Register of Deep-Sea Species
WoRMS	-- World Register of Marine Species

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