SDG indicator metadata

(Harmonized metadata template - format version 1.1)

0. Indicator information (SDG_INDICATOR_INFO)

0.a. Goal (SDG_GOAL)

Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

0.b. Target (SDG_TARGET)

Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

0.c. Indicator (SDG_INDICATOR)

Indicator 14.1.1: (a) Index of coastal eutrophication; and (b) plastic debris density

0.d. Series (SDG_SERIES_DESCR)

Chlorophyll-a deviations, remote sensing (%) EN_MAR_CHLDEV

Chlorophyll-a anomaly, remote sensing (%) EN_MAR_CHLANM

Beach litter per square kilometer (Number) EN_MAR_BEALITSQ

Floating plastic debris density (count per km2) EN_MAR_PLASDD

Beach litter originating from national land-based sources that ends in the beach (%) EN_MAR_BEALIT_BP

Beach litter originating from national land-based sources that ends in the beach (Tonnes) EN_MAR_BEALIT_BV

Beach litter originating from national land-based sources that ends in the ocean (%) EN_MAR_BEALIT_OP

Beach litter originating from national land-based sources that ends in the ocean (Tonnes) EN_MAR_BEALIT_OV

Exported beach litter originating from national land-based sources (Tonnes) EN_MAR_BEALIT_EXP

0.e. Metadata update (META_LAST_UPDATE)

2023-03-31

0.f. Related indicators (SDG_RELATED_INDICATORS)

11.6.1, 12.4.2, 12.5.1

0.g. International organisations(s) responsible for global monitoring (SDG_CUSTODIAN_AGENCIES)

United Nations Environment Programme (UNEP)

1. Data reporter (CONTACT)

1.a. Organisation (CONTACT_ORGANISATION)

United Nations Environment Programme (UNEP)

2. Definition, concepts, and classifications (IND_DEF_CON_CLASS)

2.a. Definition and concepts (STAT_CONC_DEF)

Definition:

The indicator 14.1.1 includes two sub-indicators:

- 14.1.1a Index of coastal eutrophication (ICEP), and
- 14.1.1b Plastic debris density.

The indicator 14.1.1a "Index of coastal eutrophication" (ICEP) is based on loads and ratios of nitrogen, phosphorous and silica delivered by rivers to coastal waters (Garnier et al. 2010) which contribute to the ICEP. This indicator assumes that excess nitrogen or phosphorus relative to silica will result in increased growth of potentially harmful algae (ICEP>0).

The indicator 14.1.1b "Plastic debris density" includes potential measurement of plastics washed onto beaches or shorelines, floating on the water or in the water column, deposited on the seafloor/seabed, as well as ingested by biota; however, it is also important to note the importance of monitoring information on waste management and the sources of plastic pollution for understanding plastic pollution.

Across the 14.1.1a and 14.1.1b, two mandatory levels are proposed:

Level 1: Global Data Products (globally available data from earth observations and modelling),
Level 2: National Data, which are collected from countries (through the relevant Regional Seas Programme for countries that are member of a Regional Seas Programme, or directly by UNEP).

The tables 1 and 2 demonstrate the proposed parameters for sub-indicators 14.1.1a and 14.1.1b.

Table 1: Monitoring parameters for eutrophication to track progress against SDG Indicator 14.1.1a.

Monitoring parameters	Level 1	Level 2
Indicator for Coastal Eutrophication Potential (N and P loading)	X	
Chlorophyll-a deviations (remote sensing)	X	
Chlorophyll-a concentration (*remote sensing and in situ*)		X
National modelling of indicator for Coastal Eutrophication Potential (ICEP)		X
Total Nitrogen		X
Total Phosphorus		X
Total Silica		X

Table 2: Monitoring parameters for marine plastic litter to track progress against SDG Indicator 14.1.1b.

Monitoring parameters (and methods)	Level 1	Level 2
Plastic patches greater than 10 meters*	X	
Beach litter originating from national land-based sources	X	
Beach litter (beach surveys)		X
Floating plastics (visual observation, manta trawls)		X
Water column plastics (demersal trawls)		X
Seafloor litter (benthic trawls (e.g. fish survey trawls), divers, video/camera tows, submersibles, remotely operated vehicles)		X

Concepts:

One of the largest pressures on **coastal environments is eutrophication**, resulting primarily from land-based nutrient input from agricultural runoff and domestic wastewater discharge. Coastal eutrophication can lead to serious damage to marine ecosystems, vital sea habitats, and can cause the spread of harmful algal blooms. SDG Indicator 14.1.1a aims to measure the contribution to coastal eutrophication from countries and the state of coastal eutrophication.

Eutrophication is an excess nutrient loading into coastal environments from anthropogenic sources, resulting in excessive growth of plants, algae and phytoplankton. The basis for these loads is collected from land-based assessments of land use including fertilizer use, population density, socioeconomic factors and other contributors to nutrient pollution runoff. Given the land-based nature of the indicator, it provides a modelled number indicating the risk of coastal eutrophication at a specific river mouth.

One more important characteristic is Chlorophyll-a deviation. Chlorophyll-a concentrations for this indicator are obtained from the global ocean, 4 km spatial resolution per pixel monthly mean product of the OC-CCI project product for each pixel within the country's territorial sea and exclusive economic zone.

Territorial sea is a belt of coastal waters extending at most 12 nautical miles from the baseline of a coastal state, as outlined by the United Nations Convention on the Law of the Sea.

The Exclusive Economic Zone (EEZ) is an area beyond and adjacent to the territorial sea. The EEZ shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured, as outlined by the United Nations Convention on the Law of the Sea.

Based on the existing internationally agreed Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) guidelines and the existing national data collections, it is recommended that the SDG reporting includes sub-indicators related to beach litter, floating plastic and plastic in the sea column, plastic on the sea floor and additional option indicators.

Plastic litter is most obvious on shorelines, where litter accumulates due to current, wave and wind action, river outflows and by direct littering at the coast. However, plastic litter occurs on the ocean surface, suspended in the water column, on the seabed and in association with biota, due to entanglement or ingestion (GESAMP, 2019).

Marine litter - any persistent, manufactured or processed solid material which is lost or discarded and ends up in the marine and coastal environment.

The full methodology for this indicator is available in the document entitled "Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1" (UNEP, 2021).

2.b. Unit of measure (UNIT_MEASURE)

- Chlorophyll-a deviations and Chlorophyll-a anomaly: Percent (%).
- Beach litter: Number per square kilometer, Percent (%), Tonnes.
- Floating plastic debris density: Count per square kilometer (count per km^2).
- Indicator for Coastal Eutrophication Potential (ICEP): kilograms of carbon (from algae biomass) per square kilometre of river basin area per day (kg C km^{-2} day^{-1}).

2.c. Classifications (CLASS_SYSTEM)

This indicator is classified by the Standard Country or Area Codes for Statistical Use (UN M49 classification of countries and regions).

3. Data source type and data collection method (SRC_TYPE_COLL_METHOD)

3.a. Data sources (SOURCE_TYPE)

For Level 1 indicators:

- Satellite data.
- Global models, which are based on official data from national governments as collected from UN organizations.

For Level 2 indicators:

- Data provided by national governments.

3.b. Data collection method (COLL_METHOD)

National data are collected through the Regional Seas Programmes to reduce the reporting burden on countries. For countries that are not included in a Regional Seas Programme, UNEP contacts countries directly.

For globally derived data, UNEP has established a partnership with NOAA and GEO Blue Planet, the Global Nutrient Management System (GNMS) and the Scientific Advisory Committee of the Ad hoc and Open Ended Expert Group on Marine Litter. This facilitates the production of global data products.

3.c. Data collection calendar (FREQ_COLL)

The first UNEP data collection from countries is planned in 2023. After that, direct data collection will be synchronised with the Regional Seas data collection calendar

3.d. Data release calendar (REL_CAL_POLICY)

For Level 1 data:

- Chlorophyll-a: the first reporting cycle was in 2020 and then every two years.
- Beach litter originating from national land-based sources: the first reporting cycle was in 2022.

For Level 2 data: The first UNEP data collection is planned in 2023. After that, data collection will be synchronised with the Regional Seas data collection calendar.

3.e. Data providers (DATA_SOURCE)

For Level 1 data:

- 14.1.1a: Geo Blue Planet, NOAA, Esri.
- 14.1.1b: Florida State University, EPA: European Environment Agency, Marine Litter Watch (MLW); OC: Ocean Conservancy: International Coastal Clean-up (ICC).

For Level 2 data: National governments through the Regional Seas, or directly to UNEP. More information on the Regional Seas Programme is here.

3.f. Data compilers (COMPILING_ORG)

The United Nations Environment Programme (UNEP), in collaboration with partners mentioned in the other sections of this metadata.

3.g. Institutional mandate (INST_MANDATE)

The United Nations Environment Programme (UNEP) was mandated as Custodian Agencies for indicator 14.1.1 by the Inter-agency and Expert Group on SDG Indicators.

The UNEP Regional Seas Programme is UNEP's most important regional mechanism for conservation of the marine and coastal environment since its establishment in 1974. These Multilateral Environmental Agreements are governed by their own meetings of the Contracting Parties. The individual Regional Seas Conventions and Action Plans have both a normative and implementation mandate. They provide an expression of common regional priorities, including those in the delivery of global mandates such as the 2030 Agenda, provisions of Multilateral Environmental Agreements (MEAs) and United Nations Environment Assembly (UNEA) resolutions. They also provide platforms for acting, including through integrated assessment, policy development, capacity building and exchange, as well as through implementation of projects. By building on the mandates of Regional Seas in addressing adverse impacts to the marine and coastal environment, UNEP can enhance impact and sustainability of efforts by utilization of advantages of the Regional Seas under the programme of work at the regional level.

4. Other methodological considerations (OTHER_METHOD)

4.a. Rationale (RATIONALE)

Coastal areas are areas of high productivity where inputs from land, sea, air and people converge. With over 40 percent of the human population residing in coastal areas, ecosystem degradation in these areas can have disproportionate effects on society (IGOS, 2006). One of the largest pressures on coastal environments is eutrophication, resulting primarily from land-based nutrient input from agricultural runoff and domestic wastewater discharge. Coastal eutrophication can lead to serious damage to marine ecosystems, vital sea habitats, and can cause the spread of harmful algal blooms.

Marine litter is found in all the world's oceans and seas. It constitutes an increasing risk to ecosystem health and biodiversity while entailing substantial economic costs through its impacts on public health, tourism, fishing and aquaculture. Marine plastics are of particular interest due to the fact that in the last 50 years, plastic production has increased more than 22-fold while the global recycling rate of plastics in 2015 was only an estimated 9%. This rise in plastic production and unmanaged plastic waste has resulted a growing threat to marine environments with an estimated 5-13 million tons of plastic from land-based sources ending up in marine environments.

Target 14.1 aims to reduce the impacts of pollution through prevention and reduction of marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

4.b. Comment and limitations (REC_USE_LIM)

This methodology mobilizes the collection of widely available earth observation data and other data sources which will be validated by countries. The methodologies used to generate this data are technical in nature. The methodology employs internationally recognized methods, from expert communities such as the Group on Earth Observation (GEO) and international space agencies and technical experts. There is a need to provide training on these indicators over time.

The Indicator is designed in a way to generate data to allow informed decision making towards identifying the state of pollution and pollution flows in oceans. It is assumed that countries would use the data to actively make decisions, but as oceans are transboundary, it makes this decision-making complex. Additionally, there is a need to consider data on pollution generation and waste in conjunction with these indicators.

4.c. Method of computation (DATA_COMP)

A full methodology for this indicator is available in the document entitled "Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1" (UNEP, 2021).

For 14.1.1a "Index of coastal eutrophication":

- *Level 1: Indicator for coastal eutrophication potential*

This indicator is based on loads and ratios of nitrogen, phosphorous and silica delivered by rivers to coastal waters (Garnier et al. 2010), which contribute to the ICEP, and assumes that excess nitrogen or phosphorus relative to silica will result in increased growth of potentially harmful algae (ICEP>0). The basis for these loads is collected from land-based assessments of land use including fertilizer use, population density, socioeconomic factors and other contributors to nutrient pollution runoff. Given the land-based nature of the indicator, it provides a modelled number indicating the risk of coastal eutrophication at a specific river mouth.

The indicator can be further developed by incorporating in situ monitoring to evaluate the dispersion of concentrations of nitrogen, phosphorous and silica to ground-truth the index. The indicator assumes that excess concentrations of nitrogen or phosphorus relative to silica will result in increased growth of potentially harmful algae (ICEP>0). ICEP is expressed in kilograms of carbon (from algae biomass) per square kilometre of river basin area per day (kg C km^{-2} day^{-1}).

The ICEP model is calculated using one of two equations depending on whether nitrogen or phosphorus is limiting. The equations (Billen and Garnier 2007) are:

$$ICEP\ (N\ limiting) = [NFlx/(14 * 16) - SiFlx/(28 * 20)] * 106 * 12$$
$$ICEP\ (P\ limiting) = [PFlx/31 - SiFlx/(28 * 20)] * 106 * 12$$

where *PFlx*, *NFlx* and *SiFlx* are respectively the mean specific values of total nitrogen, total phosphorus and dissolved silica delivered at the mouth of the river basin, expressed in *kg P* km^{-2} day^{-1}, in *kg N* km^{-2} day^{-1} and in *kg Si* km^{-2} day^{-1}.

- *Level 1: Chlorophyll-A deviation modelling*

Satellite-based assessments of ocean colour began in 1978 with the launch of the Coastal Zone Color Scanner (CZCS) aboard the NASA Nimbus 7 satellite. Following a decade long break in observations, there

has been continuous satellite ocean colour since 1997 with SeaWiFS, followed by MERIS, MODIS (Terra, Aqua), VIIRS (NPP, N20) and now OLCI (S-3A, S-3B). Data gaps from individual sensors are common due to revisit cycles, cloud cover, and spurious retrievals resulting from a host of confounding atmospheric and aquatic conditions. This issue has been addressed by combining data from multiple sensors and creating a consistent, merged ocean colour product (e.g., chlorophyll-a). The ESA Ocean Colour CCI (OC-CCI) project, led by the Plymouth Marine Laboratory (PML), has produced a consistent, merged chlorophyll-a product from SeaWiFS, MODIS, MERIS and VIIRS, spanning 1997 to 2018 (Sathyendranath et al., 2018). A merged multi-sensor product will be updated in both time and with data from additional sensors (e.g., OLCI) under a forthcoming EUMETSAT initiative that will continue the time series on an operational basis.

For SDG 14.1.1a, Chlorophyll-a (4 km resolution, monthly products) will be derived from the OC-CCI project is generated for each individual pixel within the country's territorial sea and EEZ. For generation of a climatological baseline, results are averaged by month over the time period of 2000 – 2004. Pixels with differences from the baseline that are in the 90th percentile of values >0 across the cumulative global EEZ and territorial sea. The percentage of pixels in a country's EEZ and territorial sea that are identified as deviating from the baseline (falling in the 90th percentile) will be calculated for each national EEZ and territorial sea by month. The annual average of these monthly values is then calculated.

- *Level 2: In situ monitoring of nutrients*

Where national capacity to do so exists, national level measurements of Chlorophyll-a and other parameters (including nitrogen, phosphate and silica) (in situ or from remote sensing), should be used to complement and ground truth global remote sensing and modelled data and enable a more detailed assessment of eutrophication. In particular, monitoring of supplementary eutrophication parameters is advisable to determine whether an increase in Chlorophyll-a concentration is directly linked to an anthropogenic increase in nutrients.

- *Level 2: National ICEP modelling*

Existing ICEP modelling at the national level is limited, but could be further developed following the model of a current study analysing basin level data in Chinese rivers (Strokal et al 2016). The study utilises Global NEWS – 2 (Nutrient Export from WaterSheds) and Nutrient flows in Food chains, Environment and Resources use (NUFER) as models. The Global NEWS-2 model is basin-scale and quantifies river export of various nutrients (nitrogen, phosphorus, carbon and silica) in multiple forms (dissolved inorganic, dissolved organic and particulate) as functions of human activities on land and basin characteristics (Strokal et al 2016). Furthermore, the model shows past and future trends.

For 14.1.1b "Plastic debris density":

- *Level 1: Plastic patches greater than 10 meters*

Satellite-based global data products make up the statistics for this indicator. NASA and ESA both contribute satellite images to construct information on the plastic patches greater than 10 meters throughout the world's oceans. Multi-spectral satellite remote sensing of plastic in the water column is currently only possible for larger elements (more than 10m) and under good atmospheric conditions (no clouds).

- *Level 1: Beach litter originating from national land-based sources*

Modelling of litter movement through the oceans occurs through numerical models using inputs including ocean flow and marine plastic litter characteristics. UNEP and Florida State University are

producing a global model of marine litter using OceanParcels v2.0, a state-of-the-art Lagrangian Ocean analysis framework to create customizable particle tracking simulation using outputs from ocean circulation models.

- *Level 2: Beach litter, plastic in the sea column and floating plastic and plastic on the sea floor (average count of plastic items per km^2)*

The details for collecting data for beach litter, plastic in the sea column and floating plastic and plastic on the sea floor are in the global manual and in the GESAMP Guidelines (GESAMP 2019). Beach litter is the most available type of data at the national level. National efforts to collect data on beach litter can be supported by campaigns to engage members of the public as volunteers in beach clean-ups (see for example the Ocean Conservancy's International Coastal Clean-up (ICC) initiative) or citizen science programmes (see for example NOAA's Marine Debris Monitoring and Assessment Citizen Science Project). Specific instructions on how to conduct citizen science beach surveys are included in the GESAMP Guidelines (GESAMP 2019).

Beyond the tools used to conduct beach litter monitoring, it is important to consider the timing of surveys in order to properly plan effective surveys. The GESAMP Guidelines explain two main types of surveying beaches including rapid assessment surveys and routine shoreline monitoring. Rapid assessment surveys are best conducted in response to natural disasters, to build a baseline for future surveys and/or to identify beach litter hotspots.

The average count of plastic items can be computed for each area sampled. A geospatial model is recommended in order to estimate the density across the coastline and to establish a national average.

4.d. Validation (DATA_VALIDATION)

The data validation for this indicator will differ according to the level classification of the indicator measured:

For Level 1 data: All globally estimated or modelled data will be shared with national statistical offices and other relevant authorities for in-country validation and replacement with national data if possible.

For Level 2 data: The United Nations Environment Programme (UNEP) and the Regional Seas will be carried out extensive data validation procedures that include built-in automated procedures, manual checks and cross-references to national sources of data. Communication will be carried out with countries for clarification and validation of data. Only data that are considered accurate or those confirmed by countries during the validation process will be reported by UNEP on the Global SDG Database.

4.e. Adjustments (ADJUSTMENT)

No adjustments are made

4.f. Treatment of missing values (i) at country level and (ii) at regional level (IMPUTATION)

For Level 1 data: Not applicable.

For Level 2 data: The United Nations Environment Programme (UNEP) and the Regional Seas do not make any estimation or imputation for missing values, so the number of data points provided are actual country data.

4.g. Regional aggregations (REG_AGG)

The data are aggregated at the sub-regional, regional and global levels. For the aggregation methods, please see here.

4.h. Methods and guidance available to countries for the compilation of the data at the national level (DOC_METHOD)

The full methodology for this indicator is available in the document entitled "Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1" (UNEP, 2021).

4.i. Quality management (QUALITY_MGMNT)

Quality management is provided by the United Nations Environment Programme (UNEP) and the Regional Seas.

4.j Quality assurance (QUALITY_ASSURE)

Quality assurance is provided by the United Nations Environment Programme (UNEP) and the Regional Seas in cooperation with the countries that provide these data.

4.k Quality assessment (QUALITY_ASSMNT)

Quality assessment is provided by the United Nations Environment Programme (UNEP) and the Regional Seas.

5. Data availability and disaggregation (COVERAGE)

Data availability:
For Level 1 data: All UN Member States.
For Level 2 data: All UN member States reporting national data.

Time series:
For Level 1 data:

- Chlorophyll-a: the first reporting cycle was in 2020 and then every two years.
- Beach litter originating from national land-based sources: the first reporting cycle was in 2022.

For Level 2 data: The first UNEP data collection is planned in 2023. After that, data collection will be synchronised with the Regional Seas data collection calendar.

Disaggregation:

A geospatial disaggregation of the state of pollution is proposed. For the ICEP loading indicators, this disaggregation should be at the sub-basin level.

6. Comparability / deviation from international standards (COMPARABILITY)

Sources of discrepancies:

There are a number of experiences in terms of collecting data on marine plastics and some do not follow a consistent methodology. Similarly, the underlying national nutrient data which feeds into national or global ICEP modelling may include discrepancies (for example, in some cases different national ministries maintain data on fertilizer, wastewater, etc.). It is recommended that national statistical systems review and work to eliminate discrepancies in the underlying data for these indictors.

7. References and Documentation (OTHER_DOC)

References:

Regional Seas Programme website

Understanding the State of the Ocean: A Global Manual on Measuring SDG 14.1.1, SDG 14.2.1 and SDG 14.5.1 (UNEP, 2021)

Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean (GESAMP, 2019)

Conceptual guidelines for the application of Marine Spatial Planning and Integrated Coastal Zone Management approaches to support the achievement of Sustainable Development Goal Targets 14.1 and 14.2 (UNEP, 2018)