

# Goal 14

**Target number:** 14.3

**Indicator Number and Name:** 14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations.

**Agency:** Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO)

## **Has work for the development of this indicator begun?**

The SDG 14.3.1 indicator methodology development began in 2016 and was presented to the IOC Assembly at its 29<sup>th</sup> session in 2017. In 2017-2018 dedicated expert meetings and consultations were organized by IOC-UNESCO. In 2018 the IOC Secretariat presented the 14.3.1 methodology to its Member States at its 51<sup>st</sup> Session of the Executive Council. The IOC Executive Council endorsed the methodology and that it be proposed for an Tier upgrade; from Tier III to Tier II.

(Meeting web page: [http://ioc-unesco.org/index.php?option=com\\_oe&task=viewEventRecord&eventID=2200](http://ioc-unesco.org/index.php?option=com_oe&task=viewEventRecord&eventID=2200), document web page: [http://ioc-unesco.org/index.php?option=com\\_oe&task=viewDocumentRecord&docID=21938](http://ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=21938)).

## **Who are the entities, including national and international experts, directly involved and consulted in developing the methodology/and or data collection tools?**

- a) IOC-UNESCO
- b) The programme International Oceanographic Data and Information Exchange (IODE) of IOC-UNESCO
- c) International Ocean Carbon Coordination Project (IOCCP)
- d) Ocean Acidification – International Coordination Centre (OA-ICC) of the IAEA
- e) Experts from the wider Global Ocean Acidification Observing Network (GOA-ON), the Executive Council of GOA-ON
- f) Experts from academic institutions working on data quality, data accuracy, multiple stressor studies

List of participants - Expert Workshop in order to develop and review the draft 14.3.1 methodology, 16-18 January 2018 ([http://www.ioc-unesco.org/index.php?option=com\\_oe&task=viewEventRecord&eventID=2204](http://www.ioc-unesco.org/index.php?option=com_oe&task=viewEventRecord&eventID=2204)):

Richard Bellerby (NIVA, Norway)  
Simon Clegg (UEA, UK)  
Kim Currie (NIWA, New Zealand)  
Sam Dupont (Gothenburg University, Sweden)  
Lina Hansson (OA-ICC of the IAEA, Monaco)  
Kirsten Isensee (IOC-UNESCO, France)  
Elizabeth Jewett (NOAA, USA)  
Max Kaplan (NOAA, USA)  
Jan Newton (University of Washington, USA)  
Benjamin Pfeil (University of Bergen, Norway)  
Nayrah Shaltout (National Institute of Oceanography and Fisheries, Egypt)  
Daniela Stoica (Laboratoire National de Métrologie et d'Essais, France)  
Adrienne Sutton (NOAA-PMEL, USA)  
Maciej Telszewski (IOCCP, Poland)  
Bronte Tilbrook (CSIRO, Australia)

### **What is the involvement of or how do you plan to involve National Statistical Systems in the development of the methodology?**

Once the indicator is operational and validated by the IAEG-SDG, IOC will have the responsibility at the global level to collect data from Member States, provide internationally comparable data in the different statistical domains, calculate global and regional aggregates, and provide data and accompanying metadata to the UN Statistical Department.

The responsibility of IOC as Custodian agency for target 14.3 is to:

- collect data in relevant domain from countries (or regional organizations as appropriate) through existing mandates and reporting mechanism to provide internationally comparable data and calculate global and regional aggregates;
- when country data are missing, estimates may be needed to fill data gaps;
- when country data collected using different methodology, data may be adjusted to make them comparable;
- identify data reported from different sources from one country that are inconsistent, and might require further adjustments ;
- develop internationally agreed standards, coordinate on the indicator development, and support increased adoption and compliance with internationally agreed standards at the national level;
- strengthen national statistical capacity and improve reporting mechanisms.

At the national level, national statistical systems or a designated national coordination body will have the task to collect data according to agreed standards and provide these data and metadata for global reporting to the IOC.

The detailed process of data collection is outlined in the 14.3.1 methodology as endorsed by IOC Member States. [http://ioc-unesco.org/index.php?option=com\\_oe&task=viewDocumentRecord&docID=21938](http://ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=21938)

### **Please briefly describe the process of developing the methodology for the indicator**

For finalising the indicator methodologies for Indicator: 14.3.1, IOC hosted an international expert workshop in January 2018 (see above), including experts from the Global Ocean Acidification Observing Network, the Global Ocean Observing System, as well as relevant regional ocean acidification networks. This meeting was followed by several rounds of online consultations with that group and IODE before presenting it again to the GOA-ON Executive Council in May 2018, where last corrections and improvements were proposed to the IOC Secretariat.

The finalized methodology, after addressing all comments and suggestions made by experts, was then presented to the IOC Executive Council at its 51<sup>st</sup> Session, where IOC Member States endorsed the process proposed by the Methodology and that the IOC Secretariat apply for an upgrade to the IAEG-SDG at its next meeting.

Between July 2018 and September 2018 the IOC Secretariat together with IODE will start the data collection exercise building on open accessed data and metadata hosted by National Oceanographic Data Centres (NODC) and IODE Associate Data Units (ADU), in collaboration with the GOA-ON Data portal. The data collection will be followed by a second expert working group meeting to assess the data, their quality and to apply the 14.3.1 categories:

- Established oceanographic climate quality (Category 1)
- Weather quality data including that from sensors and capacity building simplified pH and alkalinity measurements, with appropriate uncertainty assessment (Category 2)
- Measurements of undefined quality (Category 3) (will not be displayed in the visualization of annual weighted means and variance of pH).

The result of this exercise together with the methodology will provide the basis for the request to be made to the IAEG-SDG at its fall session to upgrade the indicator to Tier II.

### Indicator definition:

This indicator is based on observations that constrain the carbon system, which are required to capture the variability in ocean acidity at locations providing ocean services. The carbon system in this context refers mainly to the four measurable parameters: pH (the concentration of hydrogen ions on a logarithmic scale), CT (total dissolved inorganic carbon), pCO<sub>2</sub> (carbon dioxide partial pressure), and AT (total alkalinity). Ocean acidification is a reduction in the pH of the ocean over an extended period of typically decades or longer, which is caused primarily by uptake of carbon dioxide from the atmosphere<sup>1</sup>. Ocean services are the benefits the ocean provides to people, which may be recreational, economic, environmental (by providing coastal protection) or cultural. Average<sup>2</sup> as used herein is the equally weighted annual mean.

An agreed suite of representative sampling stations are sites that: 1) have a measurement frequency adequate to describe variability and trends in carbonate chemistry to deliver critical information on the exposure of and impacts on marine systems to ocean acidification, and 2) provide data of sufficient quality and with comprehensive metadata information to enable integration with data from other sites in the country.

### Timeline

July 2018	Request to selected NODCs and ADUs to provide 14.3.1 relevant data sets
September 2018	Deadline for NODCs and ADUs to provide 14.3.1 relevant data sets
October 2018	Analysis and Assessment of received 14.3.1 data sets, expert workshop
November 2018	IOC submits the agreed methodology to the IAEG-SDG – SDG indicator 14.3.1 becomes a Tier II indicator

### **Please indicate new international standards that will need to be proposed and approved by an intergovernmental process (such as UNSC) for this methodology.**

The measurements/standards for ocean acidification observation, published in peer-reviewed literature are globally accepted among scientists. For the standardized reporting, the GOA-ON serves as a quality control mechanism. In addition, the IOC Executive Council (governing body of IOC) endorsed the methodology.

### **When do you expect the methodological work on this indicator to be completed?**

The basic methodological work on the indicator will be completed in 2018. However, the technical development of related data infrastructures and the necessary capacity building, human and technological, will continue beyond that.

### **Are data and metadata already being collected from the National Statistical System for one or more components of this indicator?**

Yes

### **If yes, please describe:**

IODE and IOC HQ conducted an online survey among NODCs and ADUs in February 2018 requesting information about the national and institutional 14.3.1 related data sets.

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<sup>1</sup> The International Panel on Climate Change (IPCC) Workshop on Impacts of Ocean Acidification on Marine Biology and Ecosystems (2011, p. 37) defines Ocean Acidification (OA) as “a reduction in the pH of the ocean over an extended period, typically decades or longer, which is caused primarily by uptake of carbon dioxide from the atmosphere, but can also be caused by other chemical additions or subtractions from the ocean.”

<sup>2</sup> Although this indicator requests “average acidity” values from nations, the complete data set (which comprises the average) will provide valuable insight into the variability of the measurements

A total of 30 data centres replied positively that they host and serve biogeochemical data sets; 21 data centres serve all 4 parameters (CT, AT, pH, pCO<sub>2</sub>). However only 14 centres also provide the corresponding metadata.

The list of 21 data centres that host all 4 parameters are:

1. RBINS (Belgium)
2. BODC (UK)
3. Univ South Florida (USA)
4. JODC (Japan)
5. JMA (Japan)
6. VLIZ (Belgium)
7. DFO (Canada)
8. NCEI/OCADS (USA)
9. MIRC (Japan)
10. Univeridad Simon Bolivar (Venezuela)
11. Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP) (Argentina)
12. WHOI (USA)
13. NCEI (USA)
14. NCEI (USA)
15. Scripps (USA)
16. KMFRI (Kenya)
17. MHI/RAS (Russian Federation)
18. RSE Kazhydromet (Kazakhstan)
19. Marine Institute (Ireland)
20. Bjerknes Climate Data Centre / RI ICOS Ocean Thematic Centre (Norway)
21. National Institute of Water & Atmospheric Research (New Zealand)

### **How do you plan to collect the data?**

The 14.3.1 methodology provides detailed information about the data collection process.

(I) Counterparts:

The official counterparts are the IOC focal points. They, as well as National Oceanographic Data Centres (NODCs), will initially be contacted by IOC to request relevant data from the appropriate national oceanographic data centres and/or relevant scientists, agencies or programmes. An annual data submission request will be sent out directly to the member states asking for the respective data and metadata. It is envisaged that an online submission interface, to be developed in collaboration with existing ocean carbon data centres and biogeochemical data platforms, will facilitate the submission process in the future.

(II) Validation and consultation process:

The counterparts are invited to provide references (metadata) for the information provided.

Data quality control is a critical component of the data analysis, submission and processing. Scientists and technicians who collected the submitted data will be responsible for the primary quality control of the data and accompanying detailed metadata. The metadata submitted with the data must also describe the quality control standard operating procedures (SOPs) followed for each parameter.

Primary quality control consists of:

- Quality control that is attached to the methodology (CRMs, tris buffer calibration, SOPs are provided),
- Quality control and quality assurance of the actual data (SOPs are provided) and usage of community agreed quality flags,
- Identifying and flagging of outliers,
- Making determinations regarding validity of those outlying points,
- Estimating uncertainty of the measurement,

- Identifying all the sources of uncertainty in the measurements,
- Rolling up the individual uncertainties into overall uncertainty (error propagation).

Secondary quality control:

- Harmonization of the data and ensuring metadata completeness,
- External quality control/audit – Expert QC Group applying the weather and climate levels as defined by GOA-ON (following the example of SOCAT),
- Feedback to data holders.

Following the quality control assessment described above, three categories of measurement quality will be attributed by the Expert QC Group:

- Established oceanographic climate quality (Category 1)
- Weather quality data including that from sensors and capacity building simplified pH and alkalinity measurements, with appropriate uncertainty assessment (Category 2)
- Measurements of undefined quality (Category 3) (will not be displayed in the visualization of annual weighted means and variance of pH).

**If the indicator involves multiple components from different data sources, please describe how each individual component of the indicator will be collected here.**

Data and metadata forms will be provided to the data centre/data originator.

**With what frequency is data expected to be collected?**

Data will be collected annually (minimum).

**Is there a process of data validation by countries in place or planned for this indicator?**

Yes

**If yes, please briefly describe:**

Data validation is part of the data collection process.

The general IOC data collection process is described in Document IOC-XXIX/2Annex 14.

The novelty of assessing ocean acidification at the global level, as in indicator 14.3.1, requires the IOC secretariat to collect the data via different pathways. Future data collections and validation are expected to be a mixture of:

- direct requests to National Statistical Offices (NSOs), as new national reporting mechanisms are now installed allowing them to provide the required information,
- annual requests to the IOC national focal points,
- collaboration with National Oceanographic Data Centres, international data centres and
- directly with data providers via the GOA-ON data portal.

**If you have any additional comments that you believe would be helpful to IAEG-SDG members in analysing the work plan and methodological development of the indicator, please provide them here:**

URLs of related documentation:

GOA-ON

<http://goa-on.org/>

GOA-ON data portal

<http://portal.goa-on.org/>

IODE

<https://www.iode.org/>

IOC-UNESCO

<http://ioc.unesco.org>

Document IOC/EC-LI/2 Annex 6 -14.3.1 Methodology [http://ioc-unesco.org/index.php?option=com\\_oe&task=viewDocumentRecord&docID=21938](http://ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=21938)

Document IOC-XXIX/2Annex 14 [http://www.ioc-unesco.org/index.php?option=com\\_oe&task=viewDocumentRecord&docID=19589](http://www.ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=19589)

*(as of July/August 2018)*