UN Environment GEMS/Water

Capacity Development Centre

Sustainable Development Goal Indicator 6.3.2
Technical Feedback Process Report

UCC University College Cork, Ireland
Coláiste na hOllscoile Corcaigh
School of Biological, Earth and Environmental Sciences

eri Environmental Research Institute

Report Author: Stuart Warner

GEMS/Water Team: Greg Beechinor; Deborah Chapman; Kilian Christ; Katelyn Grant; Hartwig Kremer; Rebecca McGovern; Aoife Nagle; Philipp Saile; Kaisa Uusimaa; and Stuart Warner.

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UN Environment GEMS/Water Capacity Development Centre

Environmental Research Institute

University College Cork

Lee Road

CORK

Ireland

e-mail: gemscdcadmin@ucc.ie

Tel: +353 21 4205276

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An Roinn Tithíochta, Pleanála agus Rialtais Áitiúil
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UCC University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

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1 Introduction

The 2030 Agenda for Sustainable Development is a call for action by all UN Member States, to promote peace and prosperity. Each of the 17 Sustainable Development Goals (SDGs) addresses a single aspect of sustainable development and builds on the previous success of the Millennium Development Goals (MDGs). The SDGs include a goal specifically for water and sanitation and the UN Water Synthesis Report on Water and Sanitation (United Nations, 2018) assessed progress made towards SDG 6 and highlighted the importance of this goal in achieving many other SDGs. The report also emphasised that, based on current rates, the world is not on track to achieve SDG 6 targets by 2030 and that progress must be accelerated.

As part of Goal 6, indicator 6.3.2 aims to measure progress towards target 6.3 by assessing the effectiveness of measures to reduce pollution of freshwaters. It provides a measure of the quality of water in rivers, lakes and groundwaters, and how they change over time.

UN Environment is the custodian agency of indicator 6.3.2 with the Global Environment Monitoring System for Freshwater (GEMS/Water) acting as the implementing partner. GEMS/Water is responsible for methodological issues and oversees its implementation.

Goal 6
Ensure availability and sustainable management of water and sanitation for all
Target 6.3
By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
Indicator 6.3.2
Proportion of bodies of water with good ambient water quality

1.1 Report Objectives

This report is the culmination of a review process of the methodology of indicator 6.3.2. It collates previous feedback findings, the results of an online feedback process, and also the outcomes of a technical feedback workshop. This process expanded on previous efforts to collate feedback by engaging with those who implemented the methodology in greater depth, and also broadened the feedback group by including representatives of the scientific and technical community. The composition of the feedback group is shown in Figure 1.1.

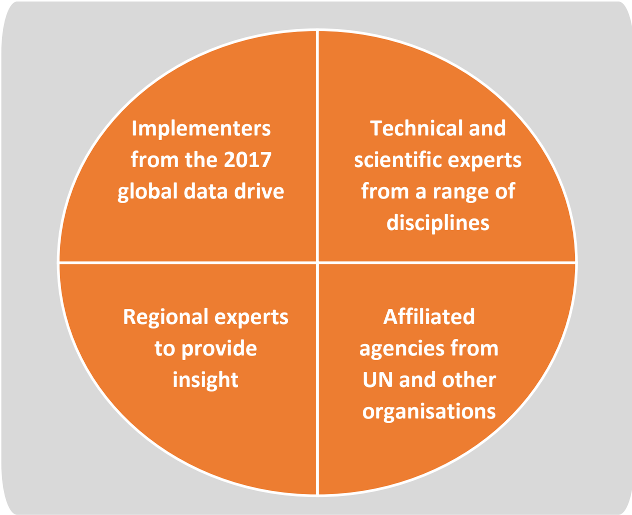

Figure 1.1 Composition of technical feedback group

The aim of the overall feedback process was to improve the methodology of indicator 6.3.2, and subsequently to:

- maximise global participation,
- enhance the national relevance of reporting indicator 6.3.2, and
- ensure that submissions are globally comparable

Central to the SDGs is that "no one is left behind", but unfortunately information on water quality, a key environmental indicator, is lacking in many parts of the world despite efforts to meet this challenge reaching back decades.

Improving the methodology will reduce barriers to reporting and will maximise participation. Reporting on indicator 6.3.2 provides a platform against which to assess the quality of water globally, and it also opens a window onto the monitoring activities in countries. It provides insight into the degree of monitoring activities and whether sufficient data are available for the reliable assessment of water quality. By highlighting countries struggling to report, this information can help channel capacity development efforts to those who need it the most and, by engaging with countries, capacity development can be tailored to suit specific needs.

The 2030 Agenda is a country-driven process. It is essential that the indicators of each target are nationally relevant and reflect country-specific pressures. In the case of target 6.3, indicator 6.3.2 should reflect the pressures on water quality that are specific for each country. Excess nutrients entering freshwater systems is a problem in most parts of the world, either from agricultural runoff or municipal wastewater, and this is accounted for in the methodology of indicator 6.3.2 by including nutrients in the core parameter list to assess water quality. In some parts of the world there are pressures to water quality that are not globally relevant and this must also be captured in the assessment of water quality. For example, some waters naturally contain high concentrations of compounds known to be harmful to human health, such as arsenic in specific groundwaters of Bangladesh (Chakraborti et al., 2010). If indicator 6.3.2 is to be relevant and of value in these country specific circumstances, it is necessary for the method to be sufficiently flexible to include relevant measures of the water quality for all countries.

For indicator 6.3.2 to be meaningful at the global level, the methodology must be sufficiently prescriptive to ensure core universal components are measured. Without a core component, the indicator reported by countries may differ considerably, particularly if countries interpret the indicator title differently, and any conclusions on regional or global progress on improving ambient water quality will be difficult to establish. This is particularly true for transboundary water bodies where neighbouring countries may use very different criteria to assess water quality leading to different conclusions on the quality of the same water body. Without a core component the comparison will not be of *like with like,* and drawing conclusions will be difficult if not impossible.

1.2 Indicator 6.3.2 progress and future

This section summarises the development of the indicator, and describes the immediate plans and the sustainability of the indicator in support of the management of water resources moving towards 2030 and beyond.

1.2.1 Pre-data drive method development

The development of the methodology builds on best practice for water quality monitoring promoted by GEMS/Water since 1978. The methodology is based on a water quality index developed in 2008 (Carr and Rickwood, 2008), which was revised and incorporated into the indicator methodology between 2014 and 2015. In 2016, as part of the Integrated Monitoring Initiative coordinated by UN-Water, the proposed indicator was tested in five countries, along with other SDG 6 indicators, in a “proof of concept” phase to determine its suitability and ease of use. In parallel to the “proof of concept” testing, feedback was obtained from numerous individual experts and international organisations who reviewed the methodology. As a result of the diverse comments and the practical attempts to implement the methodology, the approach was simplified at the end of 2016 and a revised methodology was developed and rolled-out for the 2017 data drive.

1.2.2 Data drive 2017

The 2017 data drive was the first time the updated methodology was presented to all Member States, which were then asked to report on the indicator. In addition to the written step-by-step methodology document, a series of resources were made available. These included:

- An Excel-based reporting template to capture the indicator information and certain metadata on how implementers calculated the indicator.
- A help desk to answer both administrative and technical queries.
- Live webinars were streamed in all six United Nations languages and gave the individuals tasked with reporting for their countries the opportunity to seek clarification on specific aspects of the methodology.
- Two online tutorials were created: one outlining the step-by-step methodology and the other providing more detailed technical information.
- Lastly, countries could request a country visit, organised through UN Environment, to lead them through the reporting process.

During the baseline data drive, 52 countries submitted indicator reporting data with varying levels of data coverage and completeness; for a summary refer to UN Environment (2018). In total, 47 countries assessed and classified one or more open, river or groundwater bodies (39 countries included open water bodies, 43 included river water bodies and 32 included groundwater bodies in their assessment). Four countries in Africa and one in Latin America and the Caribbean were unable to compute the indicator in time due to a lack of monitoring data, data analysis capacity or time constraints, and submitted empty or partial data reports.

1.2.3 Tier Upgrade

Indicator 6.3.2 was categorised as Tier 3 by the Inter-agency Expert Group on SDGs (IAEG-SDGs) up to, and during the data drive. The definition of Tier 3 indicators is: *“No internationally established methodology or standards are yet available for the indicator, but methodology/ standards are being (or will be) developed or tested”*. Following the data drive, the methodology was moderately revised to reflect feedback gathered, and indicator 6.3.2 was upgraded to Tier 2 in April 2018: *“Indicator is conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced by countries”*.

1.2.4 Future of the methodology

The findings of this technical feedback process will feed into the review of the methodology in readiness for the next data drive scheduled to commence in 2020. In addition, a series of technical documents are in preparation that will provide further guidance on the technical details of the methodology. Utilising the findings of this feedback process, the next data drive will aim to build on the success of the 2017 drive and expand global participation.

A critical aspect of the methodology is that it should remain “future proof”. It must ensure that sufficient metadata are collected during each drive to ensure future modifications and improvements to the methodology do not discount data collected earlier.

1.3 Indicator Report Findings

Each of the indicator teams of UN-Water's Integrated Monitoring Initiative for Goal 6 completed a progress report on the indicator that presented the initial findings from the baseline data drive of 2017 (UN Environment 2018).

The report for indicator 6.3.2 described the benefits of monitoring water quality for the SDGs, the details of the methodology, summarised the results and then went on to discuss the challenges and opportunities. The report highlighted that those Member States with available water quality data needed significant support to assess these data, and report on the indicator. This was in part due to the indicator being new and its relative complexity when compared with some of the other indicators. Water supply and sanitation were indicators under the MDGs, but ambient water quality was only added with the SDGs. The complexity comes from the reliance on an existing national capacity for monitoring, assessment, data management and reporting – which is often missing in many countries. Other key findings were:

- *Conventional approaches to monitoring water quality as well as rapidly evolving innovative data sources, such as Earth observations and citizen science, need to be employed to help fill data gaps.*
- *Sustainable Development Goal (SDG) 6 indicators would provide better information for management purposes if common, river basin-based reporting units were applied to each indicator, because this approach would identify subnational and transboundary patterns.*
- *Existing transboundary arrangements, such as river basin organizations and regional reporting frameworks, provide a platform to help align hydrological reporting units and coordinate target-setting efforts.*
- *Transboundary and regional monitoring and reporting programmes play an important role.*

1.4 Outline of technical feedback process

The technical feedback group comprised a diverse group of professionals. The process sought feedback from a cross-section of those who have direct experience of implementing the methodology. The countries were selected from all world regions and from different levels of economic development. To provide a broader outlook, the group included members of the wider technical and scientific community, regional experts and affiliated agencies from United Nations and other organisations.

Approximately 70 participants were invited to participate in the technical feedback process, and 47 positive responses were received. Each participant was sent a recorded introductory presentation, which was followed by an online consultation period that provided participants with the opportunity to contribute to seven online technical documents, each focussing on a specific challenge. The introductory presentation aimed to bring the diverse group to a common starting point by providing an overview of the feedback process, background on the SDGs, indicator 6.3.2 and GEMS/Water. The presentation went on to describe the progress to-date, and the key findings of the SDG Indicator 6.3.2 Progress Report (UN Environment, 2018). Lastly, each of key challenges that had been recognised during previous engagement with countries that implemented the methodology were described.

Following the online phase, a meeting was held in Dublin 2nd and 3rd October, hosted by Department of Housing, Planning and Local Government of the Irish Government at Customs House. This meeting sought to hear first-hand the experiences of those tasked with reporting for their countries, collate the findings of the online phase, and to develop clear strategies to improve the methodology for the next data drive. The findings of the online process and the Dublin meeting are collated in this report. The stages of the feedback process are shown in Figure 1.2.

Figure 1.2 Flow diagram of technical feedback process

2 Seven Key Challenges

Based on the feedback gathered during the 2017 data drive, seven key challenges were identified. Each can be addressed by revision of the methodology and by greater support for the reporting process. These challenges do not relate to governance, policy or enabling environment which are beyond the scope of methodological revision. The seven key challenges were:

1. **Target values** – an analysis of the target-based assessment approach used in indicator 6.3.2.
2. **Reporting units** – an examination of the spatial, sub-national reporting units used to report.
3. **Parameters** – an assessment of the value of using the prescribed core parameters.
4. **Reporting framework alignment** – an investigation into methodological flexibility that

could allow for greater alignment with existing regional reporting frameworks.

5. **Groundwaters** – a look at the issues surrounding the under representation of groundwaters in indicator 6.3.2.
6. **Additional data sources** – an examination of the potential to include data sources such as satellite-based earth observation, citizen science, private sector and modelled data into 6.3.2 reporting.
7. **Progressive monitoring concept** – an analysis of options of how to incorporate additional data and approaches to monitoring beyond the basic core reporting.

Each of these challenges are described in detail below.

2.1 Target values

During the 2017 data drive, applying the target-based approach to water quality assessment was one of the most challenging aspects for implementers of the methodology. This approach assesses water quality by comparing measured water quality values against target values. The targets for good ambient water quality should ensure that the aquatic ecosystem is healthy, and that there is no unacceptable risk to human health arising from intended use of the water without prior treatment. Target values can be of three types depending on the parameter being measured. Some parameters will have "upper" target values meaning the value should not be exceeded. As an example, a total oxidised nitrogen (TON) target concentration of 1.8 mg N/l should not be exceeded (Figure 2.1). Others will be "lower" target values, meaning the measured value should not fall below the target. An example would be the percentage of dissolved oxygen in rivers where a target value of 80 per cent is a lower target value and all measured values should remain **above** this value. Lastly some parameters will have a "range" which is the normal acceptable range of values for that parameter. For example, a range of pH between 6.5 and 8 may be acceptable for a particular lake, and a deviation from this range may be symptomatic of a water quality issue which may need further investigation.

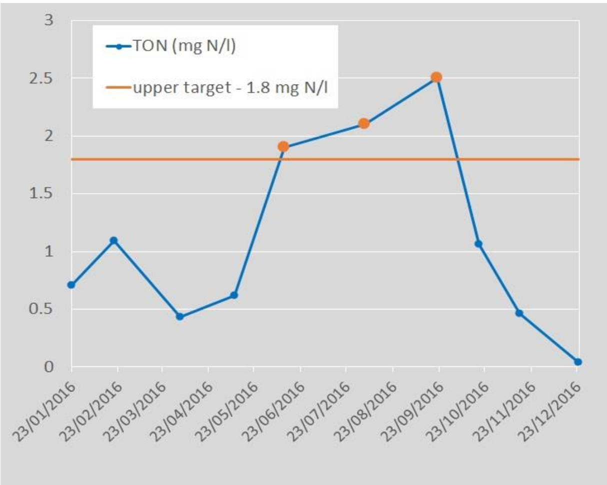

Figure 2.1 Example of an upper target value exceeded on three occasions over a period of one year

Due to the natural variability in water bodies, it is not practical to set ambient water-quality standards or targets for specific water quality parameters that are globally applicable. A target value which is suitable in one region may not be suitable in another due to natural differences. These natural influences include geology, topography, ecosystem types within the catchment area, temperature (evapotranspiration), elevation and gradient (velocity). The methodology therefore advises that each country determines its own definition of "good ambient water quality" and sets its own targets for assessing water quality.

Countries have the option of either setting national target values that apply to all water bodies of a certain type, or alternatively, they may set different target values for different monitoring locations. Setting site-specific targets is particularly relevant for the assessment of electrical conductivity data (one of the five core parameters). Categorising water quality for a given monitoring station as "good" because measured values remain within the normal range for that station, is considerably more reliable than categorising water quality as good because measured values remained below a national target value.

Using the target-based approach to water quality assessment is greatly influenced by the target values selected. For example, a lenient target value may result in a much more positive assessment of water quality. This is particularly pertinent if neighbouring countries sharing a transboundary water body choose different target values from each other for the same water body. This may result in very different assessments of water quality on either side of the border, when in reality water quality may be identical.

Based on the feedback received during and directly following the 2017 data drive, the main challenges implementers faced included:

- *Target values were not established in some countries, although they did have existing data which could be used to set target values.*
- *Neither water quality data nor target values existed.*
- *The burden to set site-specific target values was too high.*
- *In the absence of existing target values, water quality standards for purposes other than measuring ambient water quality were employed.*
- *Some countries submitted inappropriate target values, and the range of values used varied considerably.*

In addition to a general evaluation of the target-based approach to water quality assessment, participants were asked to provide feedback on the concept of an i*mproving versus degrading* method of assessment. This is broadly described as a relative assessment of water quality rather than an absolute method and would involve the comparison of water quality data for a certain reporting period with water-quality data from a previous period and avoids the requirement to set numerical target values.

2.2 Reporting Units

The term "reporting units" refers to the spatial units used to disaggregate a country's indicator score from the national score. All SDG indicators are reported at the national level, i.e. one value per country, but for Goal 6 indicators, defining reporting units which are derived from hydrological units is both intuitive and practical.

The indicator 6.3.2 methodology requests Member States to calculate the proportion of water bodies (river, lake and groundwater) that attain good status within a river basin reporting unit. This is only necessary if countries have more than one river basin. As a product of this level of data collection, the national indicator 6.3.2 value can be disaggregated by river basin, and water body type which is useful for the management of water resources.

Efforts to manage water resources, and to measure progress towards the Goal 6 water-related targets, are enhanced by reporting at the river basin scale. In reality, it is unlikely that any of the 11 Goal 6 indicators will be uniform across a country. For example, the treatment rates of wastewater may be higher in one river basin compared with another (indicator 6.3.1), or access to safely managed drinking water services may be better in one river basin compared to another (indicator 6.1.1). Reporting by river basin allows these spatial patterns to be discerned, and equally importantly allows the relationships between indicators to be mapped. For example, an understanding of where water quality is poor, will help to identify where levels of water stress may be exacerbated, by further reducing the amount of available water.

Indicator 6.3.2 is important in addressing transboundary water-quality issues and could help to stimulate greater levels of transboundary cooperation in monitoring and assessment activity. The collective efforts of riparian countries to align aspects of the methodology and reporting could serve to build a consolidated picture of the world's transboundary river basins. This coordination and cooperation between countries could be streamlined if the precondition of a defined and agreed international river basin reporting unit was met.

The main challenges implementers faced during 2017 surrounding the issue of reporting units included:

- *The methodology was misinterpreted by several countries resulting in reporting units of widely varying sizes which often did not align between countries at national borders.*
- *Efforts to align the hydrological reporting units between transboundary countries relied on existing transboundary arrangements.*

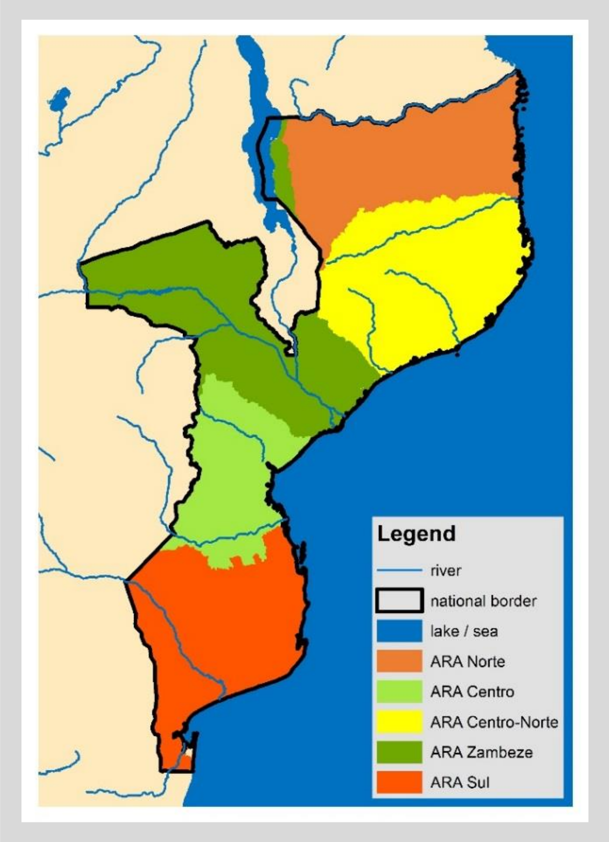

Figure 2.2 Hydrological-based management units used in Mozambique: Administração Regional de Águas (ARAs)

2.3 Parameters

The indicator 6.3.2 methodology uses a water quality index that synthesises data from the analysis of basic, core water-quality parameters. The water quality index incorporates measurements for pH, dissolved oxygen, electrical conductivity, nitrogen and phosphorus for surface waters and pH, conductivity (or salinity) and nitrate for groundwaters. The latest methodology accepted for Tier upgrade, introduced the concept of "parameter groups". This concept broadened the choice from the core parameters used in the 2017 data drive and provided greater flexibility. These groups, and the list of optional parameters are listed by water body type in Table 2.1 below.

Table 2.1 List of parameter groups and applicable parameters that can be used in assessment of indicator 6.3.2

Parameter group	Parameter options	River	Lake	Ground-water
Oxygen	Dissolved oxygen	•	•	
	Biological oxygen demand, chemical oxygen demand	•	•	
Salinity	Electrical conductivity *Salinity, total dissolved solids*	•	•	•
Nitrogen*	Total oxidized nitrogen *Total nitrogen, nitrite, ammoniacal nitrogen*	•	•	
	Nitrate**	•	•	•
Phosphorus*	Orthophosphate *Total phosphorous*	•	•	
Acidification	pH	•	•	•
*Countries should include the fractions of nitrogen and phosphorus that are most relevant nationally				
**Nitrate is suggested for groundwater due to its associated human health risks				

The main issues associated with the core parameters that implementers faced during 2017 include:

- *Some countries did not have data available for all the core parameters, either because they were not included as part of routine monitoring, or they did not have the capacity to monitor them. Therefore, they reported using only a selection of the core parameters.*
- *Some countries chose to include additional parameters to those in the core list. Some countries stated that the core parameters of Level 1 did not reflect national water quality fully and disregarded the core parameters entirely and used those that they felt were most appropriate.*

2.4 Reporting framework alignment

Certain regions have water quality reporting frameworks in place, such as the EU Water Framework Directive (WFD), the African Ministers' Council on Water (AMCOW) Africa Water Sector and Sanitation Monitoring and Reporting online system, and the State of Arab Water Report (SoAWR). It is critical that the SDG reporting framework is cognisant of these existing frameworks and that it is possible to align with these existing frameworks. Many of the issues surrounding reporting framework alignment cannot be resolved by adapting the methodology, but there are certain aspects that should be considered.

During the 2017 data drive many countries in the European region reported for indicator 6.3.2. From the feedback received, it was evident that the indicator 6.3.2 methodology was not followed closely and that many European Union countries based their 6.3.2 submissions on information reported for the WFD. The reasons for this divergence from the 6.3.2 methodology fell into two main categories: there was either a human resource deficit to fulfil the extra reporting requirements within the time constraints; or there was a perceived lack of value of the SDG indicator. This perception was valid because WFD monitoring programmes often encompass many more aspects in the evaluation of water body status, beyond the basic physico-chemical parameters used in SDG reporting, such as, parameters indicative of biological quality, hydromorphological quality, priority list and additional pollutants. These extra measures of water body status can be incorporated into reporting for 6.3.2 as Level 2 monitoring, but for global comparison the core parameters of Level 1, need to be considered first.

The AMCOW system goes far beyond the scope of both the WFD and SDG 6 and encompasses 44 water- and sanitation-related indicators. During the design phase of the AMCOW framework, efforts were made to align with the Goal 6 indicators which were still under development. As a result, many indicators share the same name, but the reporting workflow differs. Efforts to align the two frameworks more closely are underway.

There is scope to coordinate between the SoAWR and the Goal 6 indicators during the next data drive. Many of the SDG 6 indicators are mirrored in the SoAWR such as: collection of water quality data for all the core parameters used in SDG indicator 6.3.2; total wetland area and total wetland species count (indicator 6.6.1); degree of IWRM implementation (indicator 6.5.1), transboundary issues (6.5.2), water scarcity (6.4.2); sanitation access (6.2.1); water supply (6.1.1). With greater direct coordination between UN agencies responsible for SDG reporting, the Arab Water Council and Centre for Environment & Development for Arab Region & Europe (CEDARE), there is scope for greater alignment and a reduction in duplication of workload.

The main issues associated with the aligning with existing reporting frameworks include:

- *Overcoming the organisational obstacles.*
- *The additional burden of reporting.*
- *Ensuring the correct lines of communication are established in countries.*
- *Aligning reporting timeframes.*
- *Increasing the flexibility of SDG indicator 6.3.2 to allow the direct incorporation of outputs from regional frameworks*
- *Establishing data structures that allow direct integration of data collected for one regional framework into another.*

2.5 Groundwaters

The relative importance of groundwaters and surface waters differs globally, but groundwaters play a crucial role in fulfilling freshwater requirements in most parts of the world. Due to the issues surrounding the complexity and challenges facing the assessment of groundwaters, fewer countries reported on groundwaters compared with surface waters.

Monitoring programmes designed to assess groundwater quality often require a greater level of expertise to implement and interpret. A three-dimensional conceptual model of the subsurface is needed, with a knowledge of the main flow pathways. Also, an understanding of pollution pressures and pathways is needed to predict which pollutants are likely to be present and how and where they are transported.

In addition to the complexities of monitoring and assessing groundwaters, the problem is compounded by a shortage of qualified groundwater specialists and experienced well-drilling technicians in low- and middle-income countries and efforts are needed to address this capacity deficit (IAH, 2017). There is a significant need to strengthen the capacity of many countries for designing and implementing groundwater monitoring programmes, particularly regarding site selection and borehole design. In the first instance, this can be achieved by targeting capacity development at countries in which monitoring is weak and the threats to human and ecosystem health are greatest.

Difficulties that countries faced regarding applying indicator 6.3.2 to groundwaters include:

- *The core parameters were insufficient to assess water quality where there are known issues.*
- *The river basin-based reporting units were unsuitable for arid countries to apply to groundwaters.*

2.6 Additional data sources

In many countries conventional approaches to monitoring water quality are not generating sufficient data to report fully on SDG indicator 6.3.2. The feasibility of including additional data sources to those generated from conventional Ministry or Water Authority monitoring programmes is an option to increase data availability. Optional data sources include citizen-derived data, data from the private sector, data from satellite-based Earth observation and also data from biological approaches to monitoring.

There is significant interest in the potential of citizen science to deliver greater spatial and temporal coverage of water-quality monitoring data than that which is possible with traditional, laboratory-based monitoring networks. There are several organisations that are applying citizen-based methods for collection of water quality data currently. The five core parameters of indicator 6.3.2 can all be measured using a range of inexpensive and simple field techniques. Thus, where data submission can be captured electronically by the responsible organisation, these networks may serve as a useful additional source of data for indicator 6.3.2.

The most common interpretation of the term "Earth Observation" is restricted to remotely sensed, satellite-derived data and products. Strictly speaking the term has a much broader definition that includes data collected by in-situ instruments and manual methods and also by aerial remote sensing methods which use planes or drones. Earth Observation satellite data are increasingly being used for water-quality monitoring, however, although they are limited to optically detectable water-quality parameters, such as turbidity, chlorophyll and total suspended solids. The technology is currently only suitable for relatively large bodies of water, such as lakes and wide rivers because of the spatial resolution of available satellite images. Given the extensive spatial and temporal coverage of current and upcoming missions, satellite data could prove to be an important and cost-effective additional data source for monitoring large rivers and lakes in the near future.

Many private sector companies have a vested interest in maintaining a supply of good water quality and ensuring their activities do not impact downstream users. This is especially true for those which use large amounts during the production process or those which incorporate water directly into their product, such as beverage companies. Many companies monitor water quality at the point of abstraction, and also their wastewater effluents should meet prescribed limits or standards, which often involves the monitoring of water downstream of emission points. There is scope for both these intake and downstream monitoring stations to contribute to indicator 6.3.2 reporting if data are made available. Furthermore, there may be a role for private sector companies to extend their monitoring activities to help fill the data gap in countries where information is scarce within the water bodies or river basins where they are active.

Although the use of biological and ecological approaches is included as a Level 2 step in the progression of monitoring water quality, it is acknowledged that many countries already have such methods in place on which they base their judgement of ambient water quality. In a few countries the results of biological approaches are combined with physical and chemical measurements to obtain an overall judgement. No single biological or ecological method has been tried and tested at a global level, but there are some general approaches that can be used to develop indices that are useful for spatial or temporal evaluation of water quality (UNEP, 2017).

Countries were not asked to include data from additional sources during the 2017 data drive, but it was clear that this will need to be addressed in future data drives. Each potential data source has its own specific challenges that would need to be overcome in order to be included. The points that feedback group members were asked to consider are listed below:

- *How can data coherence between citizen projects and conventional monitoring programmes be ensured?*
- *Are new specific citizen projects or initiatives needed or are there existing ones which can directly provide data for indicator 6.3.2?*
- *How can citizen initiatives ensure continuity for long-term data flows?*
- *Should there be a suite of parameters included in Level 1 monitoring specifically for the purpose of validating satellite-derived data?*
- *Which are the greatest obstacles to satellite-derived data being used for the assessment of water quality?*
- *Should the methodology encourage national capacity development to use satellite-derived data, or should regional or global products be made available for countries to use?*
- *Is there a danger that proponents of satellite-derived data for water quality assessment promise too much?*
- *How can existing private sector water quality data be made available for indicator 6.3.2 reporting?*
- *Should private sector companies be encouraged to extend monitoring activities to the wider upstream catchment area of their abstraction point in data poor areas?*
- *Could companies fund monitoring programmes upstream of their intakes as part of water-stewardship programmes?*
- *Which biological methods are most appropriate for SDG indicator 6.3.2 reporting?*
- *Is it possible that a single biological method could be used globally?*

2.7 Progressive Monitoring Concept

This topic addressed how to incorporate monitoring data and assessment approaches that are beyond Level 1 monitoring. Level 1 is limited to the five core parameters for surface waters and three for groundwaters, in order to simplify the reporting workflow and to reduce the reporting burden on countries. It is fully accepted that Level 1 cannot fully represent all pressures on water quality, so the progressive steps of Level 2 monitoring are designed to try and ensure the balance between global and national relevance is met. Level 1 provides the globally comparable framework upon which more targeted, nationally relevant, monitoring programmes can be built. The progressive monitoring steps of Level 2 outlined in the methodology, encompass:

- Including additional data sources, such as satellite-derived Earth Observation, citizen-derived, private sector.
- Applying alternative assessment approaches of water quality, such as biological monitoring.
- Including data from the analysis of additional parameters, such as microbiological, heavy metals, toxic compounds, pharmaceuticals, plastics, etc.
- Using more complex classification or assessment methods, such as the proximity to target method rather than the simple binary pass or fail.

Including Level 2 data as part of the progressive monitoring concept presents a number of issues that the feedback group were asked to consider:

- *How to combine additional data sources - should the additional data streams remain separate or combined?*
- *Which is the best mechanism to include additional nationally relevant parameters or approaches to assessment?*
- *Considering all the various elements of both Level 1 and Level 2 monitoring, how certain can we be that an indicator score reflects ambient water quality accurately?*

3 Summary of Implementers' Feedback

This section presents the detailed experiences from the implementers who attended the workshop, and details the challenges they faced, and their suggestions for methodology improvements. The countries of origin of participants invited to share their experiences are shown in Figure 3.1.

3.1 Workshop overview

The workshop held 2nd and 3rd October 2018 in Dublin brought together the findings of the online consultation, and provided the opportunity to obtain feedback bilaterally, and also to resolve any outstanding issues raised during the online phase. The workshop programme and participant list are included in the Annexes.

The first day of the workshop focussed on bringing all participants to an equal level of understanding on the complexities of the challenges faced; summarised the feedback received so far; and provided the implementers of the methodology with an opportunity to share their experiences from the 2017 data drive.

Figure 3.1 Countries that presented detailed case studies at the Dublin workshop

3.2 Implementers workshop feedback

The presentations from the country implementers are synthesised in Table 3.1 to Table 3.3 below. Table 3.1 shows the indicator scores for each country along with the metadata used in the calculations. The associated metadata provides a measure of the range in monitoring activities applied in each country during the 2017 data drive.

Table 3.1 Summary of data used to calculate SDG indicator 6.3.2 during 2017 data drive by the countries present at the workshop

Country	Number of water bodies*	Number of monitoring stations	Number of monitoring values	Assessment period	Indicator score
Austria	8,256	2,496	18,641	2013 – 2015	80.44
Egypt	13	117	-	2015	53.85
Fiji	77	58	2,349	2014 – 2016	100.00
Ireland	3,083	3,678	10,707	2010 – 2015	61.69
Jamaica	101	177	1,481	2014 – 2016	92.08
Lesotho	6	29	19	2016 – 2017	16.67
Liberia	16	-	-	-	-
Peru	10	19	371	2015 – 2017	47.20
South Africa	454	551	78,304	2014 – 2016	46.92
Sweden	25,825	-	-	2010 – 2015	45.13
Tanzania	1	20	299	2014 – 2016	0.00
Uganda	8	8	8	2010 – 2015	100.00
Zambia	8	21	575	2015 – 2017	75.00

3.3 Challenges Faced During 2017

Four countries reported that applying the methodology as written was challenging as shown in Table 3.2. The underlying reasons differed between countries, ranging from the burden of reporting on human resources, to misunderstanding the written document. The burden of reporting was more evident in, but not limited to, countries which have existing onerous reporting commitments such as the European countries reporting for the WFD. One of the greatest challenges is overcoming the extra reporting burden and identifying ways to reuse existing efforts. Additionally, countries reporting to the European WFD had large volumes of data which they found challenging to incorporate into the 6.3.2 reporting template. Also, certain countries had additional data that could not be incorporated within the time frame, or they had alternative data that they felt were useful, but were not requested during the data drive. Defining target values was reported as a challenge most frequently during presentations. The setting of appropriate target values for ambient water quality was challenging for numerous reasons. Six presenters highlighted the limited monitoring activities and resources available to generate ambient water quality data in their country. Four presenters highlighted that the capacity to assess water quality data was a key deficit in their country. Whilst six mentioned that accessing and collating all available data that had potential use for reporting was challenging.

Table 3.2 Summary of main challenges faced

Country	Methodology application	Challenge to use all existing data	Definition of target values	Limited monitoring capacity	Data assessment capacity	Data access / collation / sharing	Understanding / interpreting methodology
Austria	●	●					
Egypt			●	●	●	●	
Fiji			●			●	●
Ireland	●	●					
Jamaica		●			●	●	●
Lesotho	●		●				
Liberia			●	●	●	●	
Peru		●	●				
South Africa				●		●	
Sweden	●	●					
Tanzania				●	●	●	
Uganda			●	●			
Zambia			●	●			
COUNT	4	5	7	6	4	6	2

3.4 Suggestions for the Future

The suggestions from the presenters covered a range of topic areas. One key message was that reporting would benefit from **regionalising support and training material**. This could take the form of *regional support networks* that could work collectively to identify and tackle common challenges, and also by ensuring that support material is available in local languages. It was clear that most of the presenters, who all had experience of the 2017 data drive felt that **additional training and capacity development** was required during future data drives. The type of support mentioned included: more detailed and clearer resource documents; provision of field kits; financial support for monitoring programmes; and calculation of the indicator from data repositories on behalf of countries. Central to this support would be the clarification and support on target setting procedures. Lastly, several presenters felt the **timeframe** between receiving the request and the reporting deadline was insufficient to mobilise the necessary resources and organise personnel and internal structures to report fully.

Table 3.3 Summary of suggestions for improvements to be included in the next data drive

Country	Clarification / support on target setting	Develop regional support strategy	Develop training to address regional issues, and in more languages	More time	Further capacity development / training	Financial support / external partnership	Align with WFD
Austria	●						●
Egypt	●	●	●				
Fiji	●			●	●		
Ireland		●					●
Jamaica			●	●	●		
Lesotho	●	●	●		●		
Liberia	●				●	●	
Peru		●			●		
South Africa		●		●			
Sweden				●			●
Tanzania		●			●	●	
Uganda		●			●	●	
Zambia							
COUNT	5	7	3	4	7	3	3

4 Detailed Feedback Assessment

This section presents and summarises the feedback and comments from the online phase and the discussion this generated during the workshop. Each key challenge is addressed separately below.

4.1 Target Values Feedback

During the online phase, the challenges surrounding implementing the target value concept were the first presented to the feedback group. The highlights are listed below, followed by those of the workshop.

- *Greater engagement and communication on definitions and concept are needed.*
- *Site-specific target values, rather than national target values are needed for a meaningful assessment.*
- *A typology creation exercise is needed leading to resource quality objective approach.*
- *International collaboration to build a catalogue of water body types leading to a "Human Genome-type project" to define relevant target values for all water bodies using existing published data could be pursued.*
- *There is a need to include local knowledge to set target values rather than relying on external experts.*
- *Provision of target ranges, within which targets should fall, would be a useful resource for countries striving to set targets.*

Key comments on the relative approach to assessment (improving versus degrading) include:

- *Interpretation of the indicator in this way seems to be in line with target 6.3 to improve water quality by 2030.*
- *It is critical to define how much data is needed to identify a sustained trend.*
- *Careful consideration should be given to exactly how to define thresholds – i.e. when can a water body can be classed as "improving"?*
- *A combined approach which uses both target and trend is used in the WFD for groundwaters.*

On day two of the workshop, all four groups were given the opportunity to discuss the challenges surrounding the target value-based method of assessment. The comments and suggestions are bulleted below:

- *GEMS/Water could compile and provide reference information on target values in all countries where they are available.*
- *GEMS/Water could create an international network of experts that countries could turn to, to help define target values.*
- *The target-based method is appropriate, whilst the relative approach used independently is not so useful.*
- *Regional approach to setting target values should be encouraged.*
- *More guidance on target setting is needed.*
- *The relative change assessment is important, and maybe this could be applied in parallel for targeted water bodies rather than applying for all water bodies.*
- *Could UN Environment be mandated to set guidelines that could be used by countries?*
- *A greater amount of training in the principles of water quality assessment is needed in many countries.*
- *If a relative approach is applied, it is critical that the limitations of such an approach are understood. A significant amount of data are needed and for a robust trend to be confirmed. How much is needed?*
- *A project aimed at collecting existing scientific and project data with support from GEMS/Water would be a good approach to help set appropriate site-specific target values.*
- *Relative assessment is a good idea, because it is more positive to report improving water quality, but global comparability is lost.*

The target value concept is central to the assessment of ambient water quality for indicator 6.3.2, yet its implementation proved to be a challenge to most. To ensure its application is appropriate and meaningful, the feedback suggested that additional support is required by countries. Support is needed to help countries through the target setting process, with many countries benefitting from training and guidance of the underlying principles. This is of much greater value in terms of capacity development compared with having targets prescribed by an external organisation.

It was clear that using site-specific, or typology-specific, targets provides the greatest certainty of water quality status, but setting these targets is the most demanding and requires a broad understanding of water quality assessment methods which is missing in many countries. This could in part be resolved by the provision of more detailed information on suitable target values and supporting water quality data for freshwaters in different world regions. As suggested in the feedback this could be accomplished using an international collaboration project that draws upon existing published data.

The target-based approach was preferred in general over the "relative" (improving versus degrading) form of assessment on its own, although there were several comments on the advantages of combining the two. The focus on the need for regional or transboundary cooperation to align and harmonise target values was mentioned on several occasions, and the realisation that proceeding without these efforts could lead to conflicting assessments of the same water bodies in some circumstances. This level of cooperation is included in the methodology of SDG indicator 6.5.2 on transboundary cooperation and should be pursued further.

4.2 Reporting Units Feedback

The highlights on the challenges concerning the definition, and application of meaningful spatial reporting units from the online feedback phase are listed below, followed by those of the workshop.

- *Reporting using sub-national hydrological units makes sense for indicator 6.3.2 and also provides a management framework to help align with other Goal 6 indicators*
- *Aligning efforts of riparian countries for transboundary water bodies is needed (indicator 6.5.2 team).*
- *The HydroBASINS[1] dataset has a role to play but needs work to align with national reporting units.*
- *Some good examples of existing transboundary organisations should be used.*
- *River basin delineations may not be the most appropriate reporting units for groundwaters.*

During the workshop two groups looked at the issues relating to spatial reporting units.

- *It is best to use those spatial units which are established already, but if starting from scratch then HydroBASINS should be used.*
- *Any reporting units provided by UN Environment should be provided on a "recommended only", basis rather than prescribed.*
- *Using river basin-based units for arid countries does not make sense conceptually for those used to working with groundwaters and aquifers.*
- *Support is needed to help define suitable reporting units.*
- *Monitoring programme design should be tailored to fit the reporting units.*
- *Countries will use what they have in place and not want to define new units.*
- *Artificial waterbodies that do not align to hydrological river basins do not fit into this system - for example there are thousands of kilometres of canals in Egypt.*
- *There should be an option for arid countries to use aquifer-based reporting units, especially where there is no surface water body. It does not make conceptual sense otherwise.*
- *Reporting at the national scale only provides part of the picture.*

The call for further support to define sub-national reporting units was expressed in the feedback. The position that countries may resist using reporting units that are prescribed by a UN agency, and the need for such units to align with those that may already be in use was made clear. The benefits of aligning reporting units with other indicator teams was widely supported, especially in promoting transboundary cooperation for the management of water resources.

The benefits and limitations of using the HydroBASINS dataset as a starting point for countries looking to develop hydrological reporting units was discussed. Also, extending the concept, and the potential of the dataset to provide a foundation for a global, seamless, river basin reporting layer was suggested. The example below in Figure 4.1 demonstrates how the HydroBASINS data set aligns with the hydrological-based ARAs used in Mozambique. In this example the small HydroBASINS level aligns with the national hydrological boundaries and suggests that this data could be aggregated to match any units used in countries.

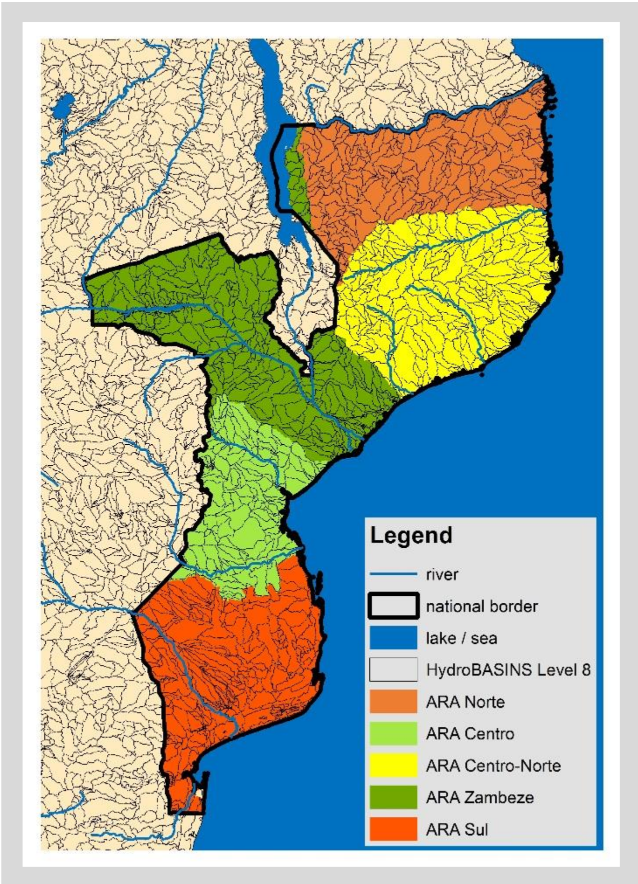

Figure 4.1 HydroBASINS Level 8 overlaid on hydrological spatial reporting units used in Mozambique

The limitations of using surface-based hydrological units was raised on several occasions. This is especially pertinent for arid countries which may have few surface waters and rely almost entirely on groundwater resources. Conceptually, the use of surface water reporting units may

[1] https://www.hydrosheds.org/page/hydrobasins

be difficult to communicate with these countries and may reduce the likelihood to engage if the indicator is perceived not to be fit for purpose. The difficulty in including artificial water bodies which may not align with hydrologically defined reporting units into indicator 6.3.2 was also raised. The water quality of these units may be equally important to rivers, lakes or groundwaters nationally, but being obliged to use river-basin units may lessen the effectiveness of assessment of these water bodies. It was suggested that in circumstances where the river basin-based units are not appropriate, that countries are given the flexibility to apply their own more appropriate reporting units – for example, in the absence of surface waters, an aquifer-based unit could be applied.

4.3 Parameters Feedback

The highlights of the online feedback regarding the challenges concerning the parameters used in the indicator calculation are listed below, followed by those from the workshop.

- *The core parameters are basic but they are sufficient.*
- *All the core parameters are useful, but there are certain practical considerations to ensure data generated are valid (e.g. pH in groundwaters, dissolved oxygen in rivers).*
- *If countries cannot measure these core parameters, then anything else is going to be problematic.*
- *Specific parameter groups for lakes should be considered – already there for groundwaters. (e.g. chlorophyll a for lakes and not for rivers).*
- *Measuring the major ions (calcium, sodium, potassium, magnesium, chloride, bicarbonate and sulphate) for groundwaters would be useful.*
- *Provision of data for earth observation validation would be useful. This could include the collection of chlorophyll a, turbidity, transparency and temperature data.*

During the workshop two groups discussed the challenges surrounding the choice of parameters used in the methodology. The suggestions are bulleted below:

- *Rather than simple Level 1 and Level 2, could a concept of a "Level 1+" list of parameters be developed which includes parameters which are known to be nationally relevant.*
- *The limitations of assessing water quality using the core five (or three for groundwaters) need to be accepted.*
- *To complement routine monitoring of the core parameters, periodic intensive sampling of a broader range of parameters might be useful.*
- *The collection of chloride data should be included for groundwaters in addition to the electrical conductivity, nitrate and pH.*
- *A geogenic parameter list should be included in Level 2. The list could include parameters that are naturally occurring but can cause human health issues, such as arsenic and fluoride.*
- *Ammonia should be monitored separately from TON (total oxidised nitrogen) for surface waters, but nitrate is sufficient for groundwaters.*

The feedback group communicated that recognising the limitations of an approach which prescribes a set of core parameters for the indicator is essential for the interpretation of any outputs. Using a core set ensures that regional or global comparability is supported, and provides a framework upon which more nationally relevant parameters can be added.

There is the opportunity to modify the core list to include parameters which could be specific to water body type. For example, specifying chlorophyll a and total phosphorus for lakes; and the major ions for groundwaters.

It was suggested that geogenic parameters which are harmful to human health should be included in the assessment of water quality for countries where these compounds are known to be present. Stating that water is of "good quality" without including for example arsenic in the assessment of groundwater in Bangladesh would be misleading.

The rise in the availability of satellite-based Earth observation technologies for water quality assessment offers many opportunities, but there is a critical need for *in situ* validation of these products. Using the SDG indicator methodology as a framework for the collection of *in situ* visually active parameters (turbidity, chlorophyll a, and transparency) provides an opportunity to help validate these products and to fill this data gap. There is a need for coordination beyond simply the collection of additional data, to ensure that data collected are fit for purpose, but there is scope for further investigation to test feasibility.

4.4 Reporting Framework Alignment Feedback

There was some useful responses collected during the feedback process which highlights the magnitude of the problem and posed some useful suggestions.

- *The reporting burden for the WFD is very substantial, and requests to report for SDG reporting are likely to be seen as a burden.*
- *In the case of AMCOW and SDG 632 alignment this could be improved by greater coordination between the AMCOW Secretariat and UN-Water.*

During the workshop two groups looked at the issues surrounding reporting framework alignment.

- *A subset of WFD SoE (State of the Environment) reporting could be used for SDG reporting.*

- *There is a need for much greater coordination between SDG and WFD reporting frameworks at many levels, including:*
    - *EU Commission level and in-country*
    - *The parameters measured*
    - *The timeframe of reporting*
    - *RBD (River Basin Districts) of WFD could be used directly for SDG reporting.*
    - *A great will to coordinate but strategic discussions are needed.*

Aligning SDG indicator 6.3.2 reporting with the WFD, AMCOW and the SoAWR frameworks has little scope to be addressed with methodological modification. The solutions lie mainly with fostering greater coordination between the custodian agencies of each framework. In the case of European WFD countries, the offer of a service which could calculate the indicator by using data from existing state of environment reports would remove the reporting burden.

4.5 Groundwaters Feedback

The feedback group included strong representation from the groundwater technical and scientific community to help address the under representation of groundwaters in the methodology, and to provide suggestions on how groundwaters can be promoted. Highlights from feedback include:

- *Designing groundwater monitoring programmes requires hydrogeologists.*
- *Groundwater provides about half of the world's drinking water, 40 per cent of agricultural water and two-thirds of river flow.*
- *Delineating groundwaters is a challenge.*
- *Microbiological contamination of groundwater is a real issue, and should be considered for inclusion in the core parameters.*
- *There are models that can help assessing geogenic and anthropogenic parameters.*
- *Using large capacity wells and springs for monitoring will, in most cases, give more representative results of conditions in the aquifer than sampling low yielding private wells.*

On the second day of the workshop two groups looked at the issues and the complexities surrounding groundwaters and their significance in indicator 6.3.2 reporting.

- *Arsenic and microbial parameters are relevant, but currently not included – they should be prescribed where relevant.*
- *There is a bias towards monitoring drinking water wells, which do not necessarily reflect the condition of groundwater as a whole.*
- *The capacity to understand groundwater flow systems is needed in order to design groundwater monitoring programmes and to interpret data generated correctly – this is missing in many countries and strong capacity development strategies are needed.*
- *A strategy to "reach out" to water utilities should be pursued to acquire existing data, and to cooperate in the supply of continuous water quality data.*
- *A pool of experts is needed. This pool could focus on specific projects such as delineating aquifer systems, or designing suitable monitoring programmes.*

The clearest message from the feedback was the need to develop groundwater monitoring and assessment capacity. The disparity between the significance of groundwater resources and the capacity to understand the hydrogeological processes which govern groundwater quality is stark in many countries. Without efforts to develop capacity, groundwaters will remain under represented in the SDG indicator 6.3.2 reporting framework. For example, delineating surface water bodies is a relatively simple task compared with delineating groundwater bodies – this is an essential first step in the assessment process which is often missing.

Collating data from the monitoring of drinking water wells in the absence of a custom-designed groundwater monitoring programme to assess the quality of water in the wider hydrogeological environment generates a bias. The quality of water in low yielding private drinking water wells may be the result of local conditions, whereas using large capacity wells and springs for monitoring will, in most cases, give more representative results.

Microbiological parameters were included in the initial list of core parameters for groundwaters, but were subsequently removed. They were downgraded from "core" to Level 2 based on feedback from implementers during the proof of concept phase of method development and technical feedback received. It was suggested that their inclusion in the core list would limit the data available for indicator calculation. If microbiological data were not available at a given monitoring station, then that station could not be included in the indicator calculation. Also, the possibility of contamination during sample collection from the locality of the wellhead reduces the certainty of results, and the subsequent assessment of water quality.

The capacity development requirements could in part be met by the creation of a network of experts who could be called upon to deliver capacity development on a case-by-case basis. This network could be built on the existing GEMS/Water network.

4.6 Additional Data Sources Feedback

The feedback group included members from each of the additional data source themes. Highlights from online feedback and how they can be utilised to support indicator

6.3.2 reporting are listed below, followed by the key workshop comments.

- *Capacity building and country ownership is critical and should be emphasised.*
- *Regional or global Earth observation products would give economy of scale.*
- *There are many projects running in both the earth observation and citizen science fields – these should be reviewed with specific relevance for indicator 6.3.2 reporting.*
- *Uncertainties in earth observation approaches need to be recognised.*
- *With all its uncertainty and acceptance issues, modelling would be an additional data/ information source.*
- *Observations by people living in an area are most useful for alerting the authorities to obvious problems.*
- *Citizen-science field kits with the range and sensitivity required for semi-quantitative evaluation should be employed. They are widely available.*
- *When run over a longer period of time, citizen-based projects can help detect changes, even with simple equipment.*
- *We should emphasise a mind-set shift: from the "best data" to the "best information". Work should proceed on standardization that includes different levels of quality data. WMO (World Meteorological Organisation) started these considerations for water quantity.*
- *a single broad approach of global biological water quality assessment may be possible; however, local adaptation to habitat types and species distribution would be necessary.*
- *DNA barcoding could be an interesting new approach, at least to get biodiversity assessed and reported over time.*
- *Many biological approaches (such as the Irish Q-Value scheme based on macroinvertebrate monitoring) have been inter-calibrated at EU level. This expertise could be drawn upon to provide guidance in terms of application to SDGs.*
- *Using private sector data will be a hard battle. Regarding the role of local public authorities. It is difficult to be both partner and enforcer.*

During the workshop all four groups were given the opportunity to discuss the challenges concerning using additional data sources for indicator 6.3.2 reporting. Due to time constraints and the expertise division amongst the participants, not every group was able to spend an equal amount of time of each potential data source. The suggestions are subdivided by theme and bulleted below.

4.6.1 Citizen-derived data

- *There are questions over the reliability of citizen science data.*
- *Citizen approaches could be useful to raise the awareness of water quality issues by engaging citizens.*
- *There are still questions that need to be answered regarding the use of citizen data because of quality assurance issues.*
- *The accuracy and precision of citizen data can be offset by volume of data generated.*
- *Alternative mechanisms to fund citizen projects are needed.*
- *Government buy-in is needed to develop citizen monitoring approaches – how can least developed countries be incentivised to adopt these approaches?*
- *The quality assurance issue of citizen-based data is well understood, the costs are inexpensive and help to empower citizens, and citizens feel they can contribute in a meaningful way.*
    - *We are at a special moment in time to link citizen science with the SDGs*
    - *Citizen approaches are an emerging technology and there still health and safety considerations that need to be accounted for.*
    - *In looking to use citizen approaches the sustainability of projects needs to be considered.*

4.6.2 Earth observation data

- *Pressure analysis using remote sensing approaches could be useful*
- *Earth observation data should be utilised for Level 2 reporting only.*
- *The validation of Earth observation data is a current limitation of using it for 6.3.2 reporting.*
- *Earth observation has a role to play in identifying hotspots that could be investigated more thoroughly using in-situ monitoring.*
- *Earth observation data should be employed in Level 2 only because it is an emerging technology.*
- *Earth observation approaches to water quality assessment are complementary to in-situ monitoring at the moment and cannot replace them. There is a danger of the approach being oversold, the uncertainty is considerable, and in-situ validation is essential. Much research is being undertaken in the area.*
- *Earth observation approaches are better for Level 2 monitoring – the feasibility has been tested in projects like UNESCO's (United Nations Educational, Scientific and Cultural Organization) and others, and it is clear that capacity development is needed.*

4.6.3 Private sector data

- *There is huge potential to utilise private sector data sources*
- *There is a lot of potential for private sector data – potential to use cloud storage facilities.*

4.6.4 Biological approaches

- *The training needed to employ biological approaches is significant, and should be Level 2 only.*

4.6.5 Additional comments

- *Could the "water stewardship concept" be promoted to encourage the private sector to collect and share data from the catchment of their source water intakes for SDG reporting?*
- *Modelling approaches and GIS (geographical information systems) could be used to help identify potential hotspots, where in-situ monitoring could be targeted.*

4.6.6 Additional data sources summary

The feedback group provided many comments and suggestions on the role of additional data sources and how they can be used to fill the data gap for indicator 6.3.2 reporting.

There are several citizen projects under way that could serve as examples, and organisations whose experience of best practice could be utilised to further test the viability of citizen data for indicator 6.3.2 reporting. Ideally, an initiative with the clear objective of testing citizen-data to report for indicator 6.3.2 is needed. This opportunity is being examined by GEMS/Water in collaboration with FreshWater Watch currently.

The potential for Earth observation data to be used for water quality assessment is substantial with many projects underway and products in development. As highlighted by technical experts during the feedback process, the scope for these advances to replace conventional methods of in situ monitoring in the near future is limited. In fact, the usefulness and certainty of Earth observation water quality assessment is strengthened by more timely and accurate in situ data, used to help validate satellite data.

Modelling approaches to water quality assessment are subject to similar constraints to those relying on satellite Earth observation. The potential of modelling is substantial, but the outputs could be significantly improved by additional in situ data to ground truth and test the models.

It was clear from the feedback group that citizen, Earth observation and modelling approaches should be used at Level 2 of SDG reporting, in support of conventional in situ monitoring programmes only. The focus of these approaches could shift from intrinsic water quality assessment to a "screening" function designed to identify hotspots; they could be used to help target resources of conventional monitoring programmes to areas where possible water quality issues have been identified.

The private sector has a role to play in support of SDG reporting, but the form this support will take is uncertain. UN Environment working in partnership with global organisations that engage with private sector companies such as CPD (formerly known as the Carbon Disclosure Project), may be able to make progress in this area. This will require method development using case studies to test the sustainability of different approaches, and should be integral to the next data drive.

4.7 Progressive Monitoring Concept

The highlights from the online feedback phase are listed below followed by the highlights from the workshop session on the challenges involved in implementing the progressive monitoring concept.

- *Keeping Level 1 and Level 2 separate makes sense. For countries that can report at level 2, you will then have information about how often the level 1 results give a different answer to level 1 combined with level 2.*
- *Ireland applied the "one out, all out approach" to reporting for the Water Framework Directive requiring a 99% confidence of EQS (environmental quality standard) exceedance. Even so, ambiguities existed between biological assessment and general physico-chemical data.*
- *In European Union reporting for chemical substances some EU Members States have reported 100% failure due to the presence of ubiquitous substances such as PAHs and Hg while others have excluded them.*
- *It may be helpful to have campaigns, possibly supported with outside funding, for countries with limited monitoring capability to do a few very detailed spot sample analyses for many variables in certain cases.*
- *A measure of uncertainty of the data should be included.*

In the interests of time, all participants discussed the challenges regarding the progressive monitoring concept together in one large group rather than being divided into smaller working groups. The main points made during the session are listed below.

- *The binary assessment method (a measured value either meets or does not meet a target with no consideration if a target is missed, by how much it misses) is a concern. A category system should be applied such as 1-3 or 1-5 categories.*
- *The simplicity of the methodology is a strength, and provides a longevity and robustness to the indicator. Efforts to create an indicator which is too complex should be approached cautiously to*

avoid losing the sustainability of the current approach.

- *There is a need to be aware of the politicisation of the term "good" and how it is used. There may be instances of grade inflation.*
- *If a "one out, all out" approach is used to combine the extra data sources used in Level 2 to Level 1, this added complexity makes it difficult to show progress over time. The more you measure the worse the assessment becomes – always!*
- *Some measure of the volumetric size of the water body should be included to normalise the score – for example the significance of one large aquifer would be lost amongst hundreds of small surface water bodies in the calculation of the indicator score.*

It was evident from the feedback process that maintaining the simplicity of the indicator methodology is necessary, but with this simplicity must come an implicit acceptance of the limitations of the water quality assessment. Continuance of the core Level 1 concept - that should be kept discrete from any additional data, approaches to monitoring, or assessment methods - builds a sustainability into an indicator that can be adapted to meet national pressures and capacities.

The "one out, all out" approach to combining additional measures of water quality was not favoured by the feedback group overall. Based on experience mainly from implementation of the WFD in Europe, this approach has led to an apparent degradation of water quality, when in reality the only change has been to increase efforts to monitor additional parameters. This approach does not encourage efforts to provide greater certainty of water quality over time, and therefore by separating and sustaining the core Level 1 avoids discouraging efforts to expand monitoring programmes.

The aggregation of different water body types in the calculation of the national indicator score may introduce a bias. This bias could be introduced assessing many more water bodies of a certain type. As described in the feedback provided by the representative from Austria, the indicator score was dominated by the assessment of hundreds of surface water bodies, yet very few groundwater bodies were assessed. A weighting factor could be applied which is based on either: the relevant importance of the water body; the monitoring effort used to assess the water body type; or the quantity of water contained within it.

The straightforward binary assessment method suggested in the indicator 6.3.2 methodology has been compared to the Canadian Council of Ministers of the Environment (CCME) water quality index (CCME, 2003) which is one of the most widely applied indices globally and found to produce similar conclusions. THE CCME method uses metrics on by how far a target is missed, how many parameters miss, and how often they miss their targets. Figure 4.2 below shows that the more straightforward SDG indicator performs similarly when the same data and target values are applied to both indices.

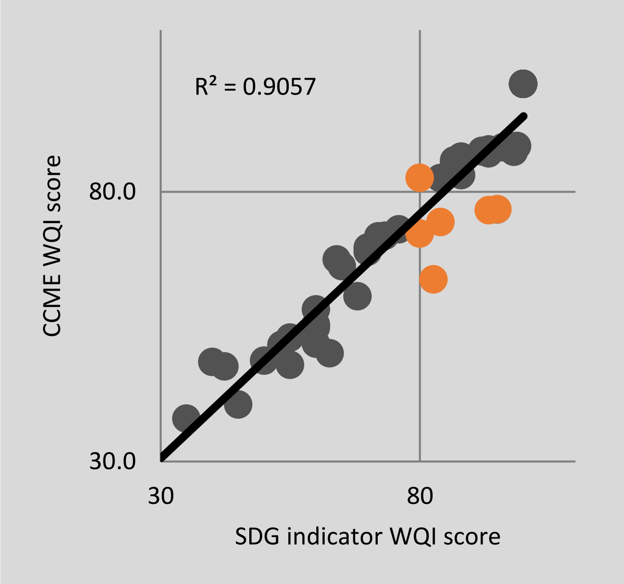

Figure 4.2 Comparison of CCME and SDG water quality indices. The orange dots signify scores that would be classified differently by the two WQIs using the 80 per cent threshold value of "good status" (Source: GEMS/Water)

5 Feedback Recommendations

The need of support for countries was one of the clearest messages that came from the feedback process. Support is needed on a number of levels from providing and communicating comprehensive guidance materials, through to calculating the indicator on behalf of countries using existing datasets.

The need for improved communication between UN agencies and the organisations responsible for reporting on indicator 6.3.2 was highlighted on several occasions. This issue has been raised previously and efforts to improve communication are underway by UN-Water which is the United Nations inter-agency coordination mechanism for water and sanitation, including SDG 6 activities.

Many excellent suggestions were proposed and comments made during the feedback process; these have been synthesised into methodological review proposals and support concepts below that will be taken forward in the readiness for the next data drive.

5.1 Target values

Greater efforts are needed to support target value setting and implementation for indicator 6.3.2 reporting of greater worth and comparability. In preparation for the next data drive a **comprehensive resource** which lists suitable target values, ranges of target values and target values used during the 2017 data drive should be made available. In addition, a clear **step-by-step guide** of the target setting process which stipulates the amount of data and the type of data needed should be produced. This would be especially useful for countries aiming to set typology-specific or site-specific target values.

Efforts of the **indicator 6.5.2 team** looking at transboundary cooperation should be pursued and collaboration strengthened. This would help identify those transboundary agreements where efforts to set joint target values have been made, and where existing mechanisms can be used to drive cooperation.

5.2 Reporting Units

The provision of an optional, global, **river basin-based reporting unit product** should be made available for all SDG 6 reporting. This layer would build on the work of the TWAP (Transboundary Waters Assessment Programme) (UNEP-DHI and UNEP 2016) that identified 286 international transboundary river basins, and augment it with suitable polygons from the HydroBASINS global dataset. Suitability of this product would be maximised by considering the hydrological reporting units already in use in countries.

5.3 Parameters

The core parameters are basic but are generally suitable to characterise water bodies and to monitor the primary sources of pollution of freshwaters (nutrients, acidification, salinization and oxygen condition). **Guidance** should be provided which refines the suitability of the core parameters. This could be additional information on the particular fractions of nutrients that are most useful to assess water bodies of certain types.

In addition to the core parameters, **suites of parameters** should be listed which could be monitored in support of alternative approaches to monitoring, or to assess certain types of pressures on water quality. An Earth observation suite for example may include, chlorophyll a, turbidity, transparency and temperature. A suite of parameters which may be useful if mining activities are present in the catchment may include, sulphate, heavy metals and hardness.

In countries where compounds known to be harmful to humans are naturally present in freshwaters, these compounds should be **included in the core parameter list**, or a note made that the assessment of good status has been made without their inclusion.

5.4 Reporting framework alignment

A great deal could be achieved by **strengthening coordination efforts** with the organisations responsible for the administering other regional reporting frameworks. For those covered in this report, efforts are ongoing with the European Environment Agency (EEA), AMCOW and the Arab Water Council (AWC). This will help reduce the duplication of effort and encourage harmonisation of water quality assessment at the global level. The most advanced of these frameworks, in terms of the quantity of data collected, is the WFD. A mechanism which directly uses data either submitted to the EEA, or from State of Environment reporting to calculate the indicator 6.3.2 score on behalf of WFD countries should be established. This could then be verified by the Member State following calculation.

5.5 Groundwaters

Groundwaters are not satisfactorily considered in the current methodology and reporting framework. More **detailed support materials** should be made available to help countries report. In addition, efforts to build capacity in monitoring and assessment of groundwaters should be encouraged.

For arid countries with limited surface water resources, the option to submit “**groundwater reporting units**”, rather than forcing groundwaters into surface water reporting units should be made available.

The core parameters of groundwaters should include the **major cations** (sodium, potassium, calcium, magnesium), and **anions** (chloride, sulphate, bicarbonate/carbonate). This would help characterise groundwaters and provide an additional quality assurance check by allowing the ion balance to be calculated.

Monitoring programme design should encourage **collection of data from large capacity wells** rather than private low capacity wells in order to provide a better picture of the wider hydrogeological environment.

5.6 Additional data sources

Projects designed to assess the **feasibility of additional data sources** in data scarce countries should be pursued. These efforts are already underway, but should be developed further during the next data drive.

Earth observation, citizen and modelling approaches could be used at the country level to help **screen** water quality issues and help target resources to monitor and assess using in situ monitoring.

Private sector companies should be encouraged to **contribute to indicator 6.3.2 reporting**, and pilot projects to test the concept should be established during the next data drive.

A globally suitable **biological monitoring approach** for surface waters should be developed. Biological approaches to assess water quality often rely on a precondition of freshwater biology capacity, but once established are more economical to operate and often provide a better overall assessment of water quality if implemented correctly.

5.7 Progressive monitoring concept

The **simplicity of the core, with flexibility to build** is key to the indicator 6.3.2 methodology. This simplicity at the core should not be lost, with the separation of Level 1 and Level 2 monitoring being maintained.

Additional data and approaches to monitoring could be combined using the "**one out, all out**" approach, but this may deter countries from developing monitoring activities. The inclusion of additional parameters will result in a "worse" assessment which may not be politically supported. This effect could be counterbalanced by creating a **certainty score**, which reflects the confidence that the water body is of the reported status.

5.8 Additional suggestions

The mobilisation and coordination of an **international network of experts** that could be called upon to aid countries was suggested. This mechanism could be extended beyond support of target setting and could help fulfil many aspects of methodology implementation. This group could be coordinated through UN Environment or GEMS/Water through their established international networks.

The **certainty score concept** mentioned above in section 5.1 above could be applied at the water body or indicator score level. It could include measures of whether:

- data from all the core parameters are included,
- if compounds known to be harmful are measured,
- whether additional parameters are measured (in addition to core and those known to be harmful),
- the quantity of data used in the assessment (greater certainty with sufficient data used),
- whether site-specific or typology-specific target values have been applied (greater certainty with greater specificity).

Establishing **regional support groups** would help mobilise regional expertise and knowledge to help seed indicator 6.3.2 implementation. An example of this type of arrangement has been established already during the workshop with participants from Zambia, Uganda, Lesotho, South Africa self-organising into a regional support group. This model should be fostered and championed during the next data drive.

The option to apply a **weighting** of relevant importance to different water body types should be offered to countries that feel an unweighted indicator calculation method fails to reflect the national picture accurately. This could be based on the national relevance of the water resource, the monitoring effort, or the quantity of water in the water body.

The core indicator score based on Level 1 monitoring alone, should not appear in isolation. It should always be accompanied by either an **additional national score** that reflects national pressures to freshwater quality, or alternatively next to a **certainty score** as mentioned above.

5.9 Conclusions

This technical feedback process has provided great insight from those who have been directly involved in the process over recent years. It has also offered a fresh perspective from those who are new to the process, who can draw from experience of water quality monitoring and assessment. It is essential that this feedback process continues during and beyond the next data drive, to ensure the methodology is continuously refined and the experiences of those implementing the methodology for the first time are captured.

This process has led to clear suggestions based on experiences from countries that differ in geography and level of socio-economic development, and also from expert scientific and technical opinion. This input can be used to advance the methodological development of indicator 6.3.2 during the next data drive.

The continued improvement of the methodology based on feedback is fundamental to indicator 6.3.2, and without which, it will be difficult to:

- maximise global participation,
- enhance the national relevance of reporting indicator 6.3.2, and
- ensure that submissions are globally comparable.

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Annexes

Annex 1: Workshop Programme

SDG indicator 6.3.2 Technical Feedback Group meeting

2 - 3 October 2018

Customs House, Dublin, Ireland

Tuesday 2 October		Facilitator
08.30 – 09.00	Registration	All participants
09.00 – 09.15	Official welcome	Irish Govt. Representatives
09.15 – 09.30	Brief introduction to GEMS/Water	GEMS/Water
09.30 – 10.00	Brief overview of process and objectives of the meeting	GEMS/Water
10.00 – 10.30	Introduction of participants	All participants
10.30 – 11.00	Refreshments	
11.00 – 11.30	Summary of the Tier II 6.3.2 methodology	GEMS/Water
11.30 – 12.00	6.3.2 indicator report findings	GEMS/Water
12.00 – 12.30	Summary of online consultation feedback	GEMS/Water
12.30 – 13.00	Discussion session	All participants
13.00 – 14.00	Lunch	
14.00 – 15.15	Case studies of implementers' experiences from 2017 data drive	Country implementers
15.15 - 15.30	Summary of discussion of implementers' feedback	GEMS/Water
15.30 – 16.00	Refreshments	
16.00 – 16.45	General methodology discussion – key points	All participants
16.45 – 17.00	Day 1 close and summary	GEMS/Water
17.30 – 18.30	Reception in Customs House	
19.00 – 21.00	Dinner	

Wednesday 3 October			Facilitator
09.00 – 09.15	Welcome and organisation for day 2		GEMS/Water
09.15 – 10.30	Discussion topic 1		All participants
10.30 – 11.00	Refreshments		
11.00 – 12.00	Discussion topic 2	Discussion topic 3	All participants
12.00 – 13.00	Discussion topic 4	Discussion topic 5	All participants
13.00 – 14.00	Lunch		
14.00 – 14.30	Plenary of breakout discussions		Group rapporteurs
14.30 – 15.30	Discussion - Additional data sources		All participants
15.30 – 16.00	Refreshments		
16.00 – 16.30	Discussion - Progressive monitoring concept		All participants
16.30 – 16.45	Summary and next steps		GEMS/Water
16.45 – 17.00	Official close of meeting		Irish Govt. Representatives
19.00 – 21.00	Dinner		

Annex 2: List of workshop participants

SDG Indicator 6.3.2 Technical Feedback Meeting Participant List – Customs House Dublin. October 2nd and 3rd

Country	Participant Name	Organisation
Liberia	**Abdul Koroma**	National Water Sanitation and Hygiene Promotion Committee
Ireland	**Aidan Fitzpatrick**	Irish Aid
Ireland	**Aoife Nagle**	GEMS/Water CDC
Ireland	**Brendan Tuohy**	Former Department of Communications, Marine and Natural Resources
Ireland	**Bruce Mistear**	International Association of Hydrogeologists
Peru	**Carmen L. Yupanqui Zaa**	Autoridad Nacional del Agua
Ireland	**Cian O'Lionain**	Department of Housing, Planning and Local Government
Ireland	**David Walker**	Department of Housing, Planning and Local Government
Ireland	**Deborah Chapman**	GEMS/Water CDC
Switzerland	**Douglas Cripe**	GEOGlows/Aquawatch
Austria	**Ernst Überreiter**	Federal Ministry for Sustainability and Tourism, National and International Water Policy
Zambia	**Frank Nyoni**	Water Resources Management Authority
Ireland	**Greg Beechinor**	GEMS/Water CDC
Denmark	**Hartwig Kremer**	GEMS/Water GPCU
Germany	**Ilona Bärlund**	Helmholtz Centre for Environmental Research-UFZ
Ireland	**Jamie Keating**	Google Earth Engine
Ireland	**Katelyn Grant**	GEMS/Water CDC
The Netherlands	**Ken Irvine**	IHE-Delft
Egypt	**Khaled AbuZeid**	CEDARE
Ireland	**Les Carberry**	Department of Communications, Climate Action and Environment
Uganda	**Lilian Idrakua**	Ministry of Water and Environment
UK	**Luigi Ceccaroni**	EarthWatch/FreshwaterWatch
Sweden	**Måns Denward**	Swedish Agency for Marine and Water Manangement (SwAM)
Lesotho	**Matsolo Migwi**	Department of Water Affairs (DWA)
South Africa	**Mike Silberbauer**	Department of Water and Sanitation (DWS)
UK	**Orlaith Delargy**	CDP (Carbon Disclosure Project)
Ireland	**Peter Webster**	Former EPA
Germany	**Philipp Saile**	GEMS/Water Data Centre
Germany	**Ralf Klingbeil**	BGR (Federal Institute for Geosciences and Natural Resources)
Germany	**Sabrina Julie Kirschke**	United Nations University
France	**Sarantuyaa Zandaryaa**	UNESCO
Jamaica	**Schmoi McLean**	Statistical Institute of Jamaica
Fiji	**Sher Singh**	Water Authority of Fiji
Ireland	**Stuart Warner**	GEMS/Water CDC
Germany	**Tamara Avellán**	United Nations University