6 CLEAN WATER AND SANITATION

Progress on Ambient Water Quality

Piloting the monitoring methodology and initial findings for SDG indicator 6.3.2

2018

UN WATER

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University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

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Presenting the UN-Water Integrated Monitoring Initiative for SDG 6

Through the UN-Water Integrated Monitoring Initiative for Sustainable Development Goal (SDG) 6, the United Nations seeks to support countries in monitoring water- and sanitation-related issues within the framework of the 2030 Agenda for Sustainable Development, and in compiling country data to report on global progress towards SDG 6.

The Initiative brings together the United Nations organizations that are formally mandated to compile country data on the SDG 6 global indicators, who organize their work within three complementary initiatives:

- **WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP)**[1]

  Building on its 15 years of experience from Millennium Development Goals (MDG) monitoring, the JMP looks after the drinking water, sanitation and hygiene aspects of SDG 6 (targets 6.1 and 6.2).

- **Integrated Monitoring of Water and Sanitation-Related SDG Targets (GEMI)**[2]

  GEMI was established in 2014 to harmonize and expand existing monitoring efforts focused on water, wastewater and ecosystem resources (targets 6.3 to 6.6).

- **UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS)**[3]

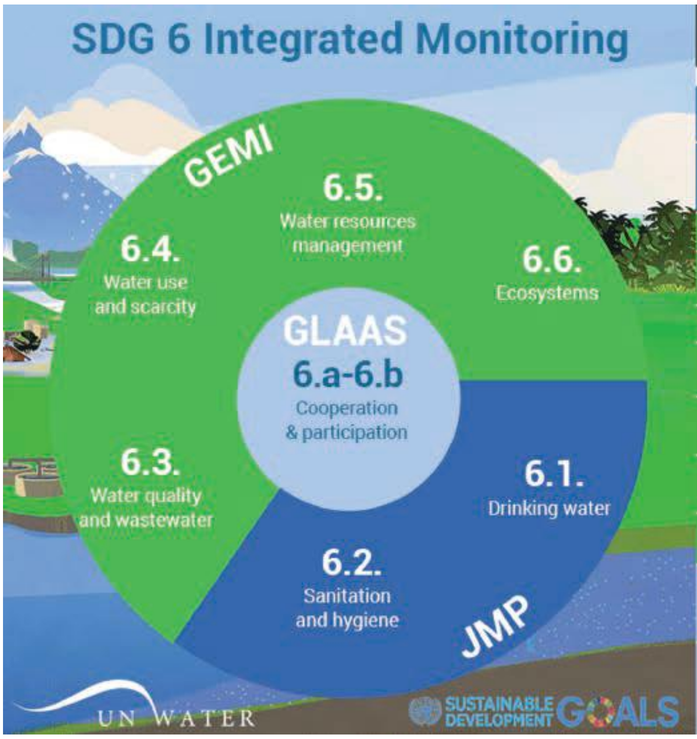
  The means of implementing SDG 6 (targets 6.a and 6.b) fall under the remit of GLAAS, which monitors the inputs and the enabling environment required to sustain and develop water and sanitation systems and services.

The objectives of the Integrated Monitoring Initiative are to:

- Develop methodologies and tools to monitor SDG 6 global indicators
- Raise awareness at the national and global levels about SDG 6 monitoring
- Enhance technical and institutional country capacity for monitoring
- Compile country data and report on global progress towards SDG 6

The joint effort around SDG 6 is especially important in terms of the institutional aspects of monitoring, including the integration of data collection and analysis across sectors, regions and administrative levels.

To learn more about water and sanitation in the 2030 Agenda for Sustainable Development, and the Integrated Monitoring Initiative for SDG 6, visit our website: www.sdg6monitoring.org



INDICATORS	CUSTODIANS
6.1.1 Proportion of population using safely managed drinking water services	WHO, UNICEF
6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water	WHO, UNICEF
6.3.1 Proportion of wastewater safely treated	WHO, UN-Habitat, UNSD
6.3.2 Proportion of bodies of water with good ambient water quality	UN Environment
6.4.1 Change in water-use efficiency over time	FAO
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	FAO
6.5.1 Degree of integrated water resources management implementation (0-100)	UN Environment
6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation	UNESCO, UNECE
6.6.1 Change in the extent of water-related ecosystems over time	UN Environment, Ramsar
6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan	WHO, UN Environment, OECD
6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management	WHO, UN Environment, OECD

[1] http://www.sdg6monitoring.org/about/components/jmp/
[2] http://www.sdg6monitoring.org/about/components/presenting-gemi/
[3] http://www.sdg6monitoring.org/about/components/glaas/

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Wild Birds resting on Chale Swamp Lake near Dodoma. Photo: UN Photo/B Wolff

FOREWORD

Water is the lifeblood of ecosystems, vital to human health and well-being and a precondition for economic prosperity. That is why it is at the very core of the 2030 Agenda for Sustainable Development. Sustainable Development Goal 6 (SDG 6), the availability and sustainable management of water and sanitation for all, has strong links to all of the other SDGs.

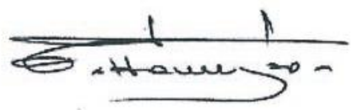
In this series of progress reports under the UN-Water Integrated Monitoring Initiative for SDG 6, we evaluate progress towards this vital goal. The United Nations organizations are working together to help countries monitor water and sanitation across sectors and compile data so that we can report on global progress.

SDG 6 expands the Millennium Development Goal focus on drinking water and basic sanitation to include the management of water and wastewater and ecosystems, across boundaries of all kinds. Bringing these aspects together is an essential first step towards breaking down sector fragmentation and enabling coherent and sustainable management, and hence towards a future where water use is sustainable.

This report is part of a series that track progress towards the various targets set out in SDG 6 using the SDG global indicators. The reports are based on country data, compiled and verified by the responsible United Nations organizations, and sometimes complemented by data from other sources. The main beneficiaries of better data are countries. The 2030 Agenda specifies that global follow-up and review "will be primarily based on national official data sources", so we sorely need stronger national statistical systems. This will involve developing technical and institutional capacity and infrastructure for more effective monitoring.

To review overall progress towards SDG 6 and identify interlinkages and ways to accelerate progress, UN-Water produced the SDG 6 Synthesis Report 2018 on Water and Sanitation. It concluded that the world is not on track to achieve SDG 6 by 2030. This finding was discussed by Member States during the High-level Political Forum on Sustainable Development (HLPF) in July 2018. Delegates sounded the alarm about declining official development aid to the water sector and stressed the need for finance, high-level political support, leadership and enhanced collaboration within and across countries if SDG 6 and its targets are to be met.

To achieve SDG 6, we need to monitor and report progress. This will help decision makers identify and prioritize what, when and where interventions are needed to improve implementation. Information on progress is also essential to ensure accountability and generate political, public and private sector support for investment. The UN-Water Integrated Monitoring Initiative for SDG 6 is an essential element of the United Nations' determination to ensure the availability and sustainable management of water and sanitation for all by 2030.



Gilbert F. Houngbo
UN-Water Chair and President of the International Fund for Agricultural Development

FOREWORD

Last year, the Kanyama community living on the fringes of Lusaka, the capital of Zambia, was hit by a cholera outbreak. The outbreak, which killed many people, was traced back to faecal contamination that had polluted groundwater. Unfortunately, what happened in Lusaka is not uncommon. Across the world, many people depend on water taken directly from rivers and wells. The quality of water we drink is as much under threat as access to water itself.

UN Environment is proud to support a series of reports that assess the world's progress on Sustainable Development Goal 6, which aims to ensure availability and sustainable management of water and sanitation for all. In this report, we report on progress made by countries on the proportion of bodies of water with good ambient water quality.

The tragedy in Zambia highlights the importance of looking at the bigger picture of water quality, acknowledging the close links between water quality, the health of our freshwater ecosystems, availability of drinking water and access to sanitation. Such an analysis is critical to helping countries correctly identify the sources of pollution and take steps to protect the future of people and environment alike. Importantly, we hope it can guide us in strengthening national monitoring networks and ensuring high-quality data, as a first step towards more sustainable water management.

Erik Solheim
UN Environment Executive Director and Under-Secretary-General of the United Nations

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UN Environment Global Environment Monitoring System for Freshwater (GEMS/Water): Kilian Christ, Hartwig Kremer, Kaisa Uusimaa

The review and feedback received from the GEMI project team and the UN water members and partners is gratefully acknowledged.

Financial support was provided by the German Federal Ministry for Economic Cooperation and Development (BMZ), the Dutch Ministry of Infrastructure and Water Management, the Swedish International Development Cooperation Agency (SIDA) and the Swiss Agency for Development and Cooperation (SDC).

REPORT HIGHLIGHTS

Reliable water-quality monitoring data are required to assess the status and trends of water quality for human and ecosystem health, and to inform policymakers in taking appropriate decisions conducive to water resource protection and restoration, in terms of both water bodies and water-related ecosystems. Especially in economically marginalized communities better knowledge about the status of ambient water quality is of special value for the protection of women and children who are vulnerable to water quality deterioration due to their frequent contact with surface water bodies for household and play activities.

Many Member States need support to report on indicator 6.3.2 throughout the reporting process. This indicator is comparatively newer than others, and while the underlying methodology is technically straightforward, it remains challenging and relies on an existing national monitoring capacity.

Reporting for indicator 6.3.2 provides countries that do not currently have the capacity to report in full with a benchmark against which to measure their own progress. The steps of the methodology advise that countries start with a monitoring effort that focuses on selected key water bodies for which reliable, scientifically sound data can be delivered. This should then be expanded as additional resources are made available.

There is a lack of freshwater quality data in many of the least developed countries. During the 2017 data drive there were 52 submissions from 193 Member States; however, some submissions relied on very few data points. The conclusions drawn from these assessments could be improved by incorporating data at higher spatial and temporal resolutions.

Indicator 6.3.2 provides a universal standard for measuring national capacity for water-quality monitoring. It highlights deficits in water-quality monitoring capacity at the national and subnational level; this information can then be used to target capacity development strategies.

Conventional approaches to monitoring water quality and 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, as this approach would identify subnational and transboundary patterns.

National progress towards achieving target 6.3 cannot be measured without the information provided by indicator 6.3.2. To be able to improve water quality, a benchmark is needed. Without this means of comparison, efforts to eliminate dumping, minimize the release of hazardous chemicals and materials, and tackle wastewater treatment and reuse will go undetected, and their success or failure will be unknown.

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 in improving the amount and quality of water-quality monitoring data, as well as information products derived from these, available to assess the quality of freshwater ecosystems.

1

Why monitor ambient water quality for SDGs?

Water quality analysis in Nambak District Lao PDR. Photo: Asian Development Bank

This section highlights the importance of good ambient water quality and the interlinkages between indicator 6.3.2 and other SDG 6 indicators, as well as the importance of target 6.3 in achieving many of the other SDGs.

1.1. Indicator 6.3.2: monitoring water quality for ecosystem and human health

Good water quality in our rivers, lakes and groundwaters is critical for sustainable development and global health in terms of providing basic services and enabling economic activities. Understanding ambient water quality facilitates an evaluation of the impact of socioeconomic development on the quality of our freshwater over time and provides an indication of the services that can be obtained from aquatic ecosystems, such as clean water for drinking, preserved biodiversity, sustainable fisheries and water for irrigation. Monitoring water quality also enables us to understand where water quality is under pressure and where it remains in its natural state. It provides decision makers with information on where best to direct resources to reduce pollution, and it provides a measure of the success of pollution prevention and mitigation strategies.

Freshwater comprises less than 1 per cent of the total volume of water on Earth, yet this small proportion supplies many services that are critical for sustainable development. Ecosystem's capacity to assimilate wastes are being pushed beyond their limits (Liu *et al.*, 2012) due to global population growth and increasing socioeconomic activity. An estimated 80 per cent of wastewater is discharged into water bodies without any prior treatment , and industry is globally responsible for dumping tons of heavy metals, solvents and other wastes directly into water bodies each year (WWAP, 2017). Agricultural sources of pollution, such as run-off of fertilizers and pesticides, are also a major threat to water quality in many countries, and with pressure to intensify agricultural output to cater for a growing population, this is likely to increase further. Despite attempts to understand global trends in the quality of freshwater, adequately assessing the quality status of freshwater bodies remains a formidable challenge in many parts of the world (Bhaduri *et al.*, 2016).

Water quality is subject to spatial variability depending on land use, climate and geology, but also to temporal

KEY FACTS

Freshwater monitoring programmes are insufficiently funded in many countries, especially in some of the least developed countries where pressures from growing populations and industrial output are increasing.

Freshwater ecosystems are some of the **most impacted ecosystems** worldwide.

Removing hazardous pollutants at source and safely treating wastewater create opportunities for increasing the safe reuse of water to combat water scarcity.

variability at daily through to seasonal, annual and decadal scales. These natural patterns over multiple scales need to be understood to be able to elucidate anthropogenic and climate change-driven impacts. Freshwater monitoring programmes such as those prescribed in the indicator 6.3.2 methodology, with appropriate spatial and temporal resolution, are key priorities for improving water quality and achieving target 6.3.

Indicator 6.3.2 is defined as the "Proportion of bodies of water with good ambient water quality". Ambient water quality refers to natural, untreated water that is affected by a combination of natural influences and anthropogenic activities, such as inputs from wastewater or agricultural run-off. Water quality indices are a useful tool for communicating often complex water-quality assessments in the form of individual numbers that are more meaningful to non-experts. Currently, there are approximately 30 to 40 commonly used indices worldwide (Lee *et al*., 2017). The indicator 6.3.2 methodology uses a water quality index that synthesizes data from the analysis of basic, core water-quality parameters. Some of these parameters are direct measures of water quality for ecosystem or human health, while others are included to characterize the water body. Deviation from normal ranges (in the case of electrical conductivity and pH), or values that exceed (phosphate and nitrogen) or fall below (dissolved oxygen) expected target values, are very often symptomatic of impacts on water quality. A threshold value of 80 per cent compliance is defined to classify water bodies as "good" quality. Thus, a body of water is classified as being of good quality if at least 80 per cent of all monitoring data from all monitoring stations within the water body comply with the respective targets.

The methodology requires Member States to report a national indicator score. This score is reported based on river basins, which are then subdivided into smaller water body units, such as sections of a river, a lake or an aquifer. This level of disaggregation facilitates the repackaging of indicator components to support regional, transboundary and subnational water-quality assessments.

Indicator 6.3.2 reporting helps to identify data-poor areas at multiple scales. It will highlight Member States that are unable to report because of insufficient monitoring activities. This information can then be used to identify regions where data are scarce and help target capacity development efforts. Similarly, monitoring efforts are not equal within countries; where resources are limited, emphasis is often placed on key water bodies that are relied upon more heavily. Reporting on indicator 6.3.2 elucidates these spatial discrepancies.

Indicator 6.3.2 provides information that can be useful at various levels across the water sector. Monitoring water quality at the point of use only, for example, at an abstraction point for a drinking water or irrigation source, provides a "keyhole view" on water quality. Monitoring it at the river basin or national level, on the other hand, is comparable to taking your eye away from the keyhole, opening the door and stepping outside – the view is much improved! It provides information on the potential pressures on water quality, and it can instil confidence that the water quality at the point of use will remain fit for purpose and that neither human nor ecosystem health is being damaged. If pressures on the basin are impacting water quality, an ambient water-quality monitoring programme can provide details on the source and

Indicator 6.3.2 methodology essentials

- Reporting on indicator 6.3.2 requires a water-quality monitoring programme that collects **in situ** water-quality samples from freshwater bodies, including **rivers**, **lakes** and **groundwaters**.
- Samples are analysed, the data must be well managed and stored, and the data needs to be assessed and then made available for reporting.
- The methodology uses a **water quality index** to assess water quality.
- The water quality index incorporates measurements for **pH**, **dissolved oxygen**, **electrical conductivity**, **nitrogen** and **phosphorus** (pH, conductivity/salinity and nitrate for groundwaters).
- Measured values are compared with **target values** that represent water quality that will not be harmful to either human or ecosystem health.
- ***Good ambient water quality*** means that the target values have been met at least 80 per cent of the time during the assessment period.
- ***Bodies of water*** may refer to sections of a river or a small river sub-basin, a lake or an aquifer.
- Indicator 6.3.2 is reported at the national level, but also at the subnational level based on **river basins**.

BOX 1

Monitoring ambient water-quality data's influence on policy

Freshwater monitoring programmes are insufficiently funded in many countries, especially in some of the least developed countries where pressures from growing populations and industrial output are increasing. The role of clean bodies of freshwater and the need to establish monitoring programmes for them are often included in national legislation aimed at environmental protection. However, in reality, due to resource constraints, the monitoring programmes either fail to collect data or the data collected are insufficient to support indicator 6.3.2 reporting. The monitoring programmes may lack national coverage or data may be collected on a sporadic project basis, and there may be gaps in the data record.

Nitrogen is a vital nutrient that cycles through different forms and is crucial for plant growth and functioning ecosystems. However, high concentrations in surface- and groundwaters derived from excessive inputs from agriculture and wastewater effluents are harmful to both human and ecosystem health.

The Nitrates Directive (91/676/EEC)[1] provides a good example of how water-quality data are used to recognize rising nitrate levels in Europe's surface- and groundwaters, and of how continuous monitoring can be used to track the effectiveness of legislation introduced to address the problem. The agricultural use of nitrates in organic and chemical fertilizers continues to be a major source of water pollution in Europe, but also globally; nitrate is the most common chemical contaminant in the world's groundwater aquifers (WWAP, 2017).

To implement the directive, Member States are required to:

- monitor the quality of water with regard to nitrate concentrations and trophic status
- identify waters that are polluted or at risk of pollution, based on monitoring data
- designate nitrate vulnerable zones (NVZs) – areas of land that drain into waters and that contribute to pollution
- establish codes of good agricultural practice
- establish action programmes to reduce nitrate pollution

Key messages (European Commission, 2018):

- Between the two most recent reporting periods (2008–2011 and 2012–2016), slight improvements in nitrate concentrations in groundwaters and surface waters were observed, but there was no uniform pattern across all countries.
- For groundwater quality:
  - 32 per cent showed an improvement (reduction in nitrate concentration)
  - 26 per cent showed a deterioration (increase in nitrate concentration)
- For surface water quality:
  - 31 per cent showed an improvement
  - 19 per cent showed a deterioration
- Polarization in trends is apparent in some countries, with areas of good water quality improving and polluted areas deteriorating.
- Challenges remain to ensure that the directive is effective as possible:
  - The level of reporting (density of monitoring stations) and the methods used in measuring trophic status vary greatly between countries and harmonization is needed.
  - Governance and coordination between stakeholders needs to be improved.
  - Efforts to strengthen action programmes in some countries are required.

The Nitrates Directive (1991) aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0676

extent of individual impacts, as well as on trends over time and the effectiveness of measures taken to reduce these impacts. With sound, reliable water-quality data, these impacts can be assessed within the context of all impacts on and processes within the water body; this is critical for separating human-driven impacts from natural phenomena.

1.2. Aims and objectives of the report

This report highlights the importance of good ambient water quality and the interlinkages between indicator 6.3.2 and other SDG 6 indicators, as well as the importance of target 6.3 in achieving many of the other SDGs. The report summarizes the progress made to date on indicator 6.3.2, focusing on the 2017 global data drive, and reflects on the process and the lessons learned from feedback and engagement. It also presents an analysis of the submissions received, focusing on the global disparities in water-quality monitoring capacity and the various reporting challenges that Member States face, and suggests how this information can be used to shape the development of the methodology. And lastly, it highlights the level of support that certain countries need to report the indicator.

1.3. 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"

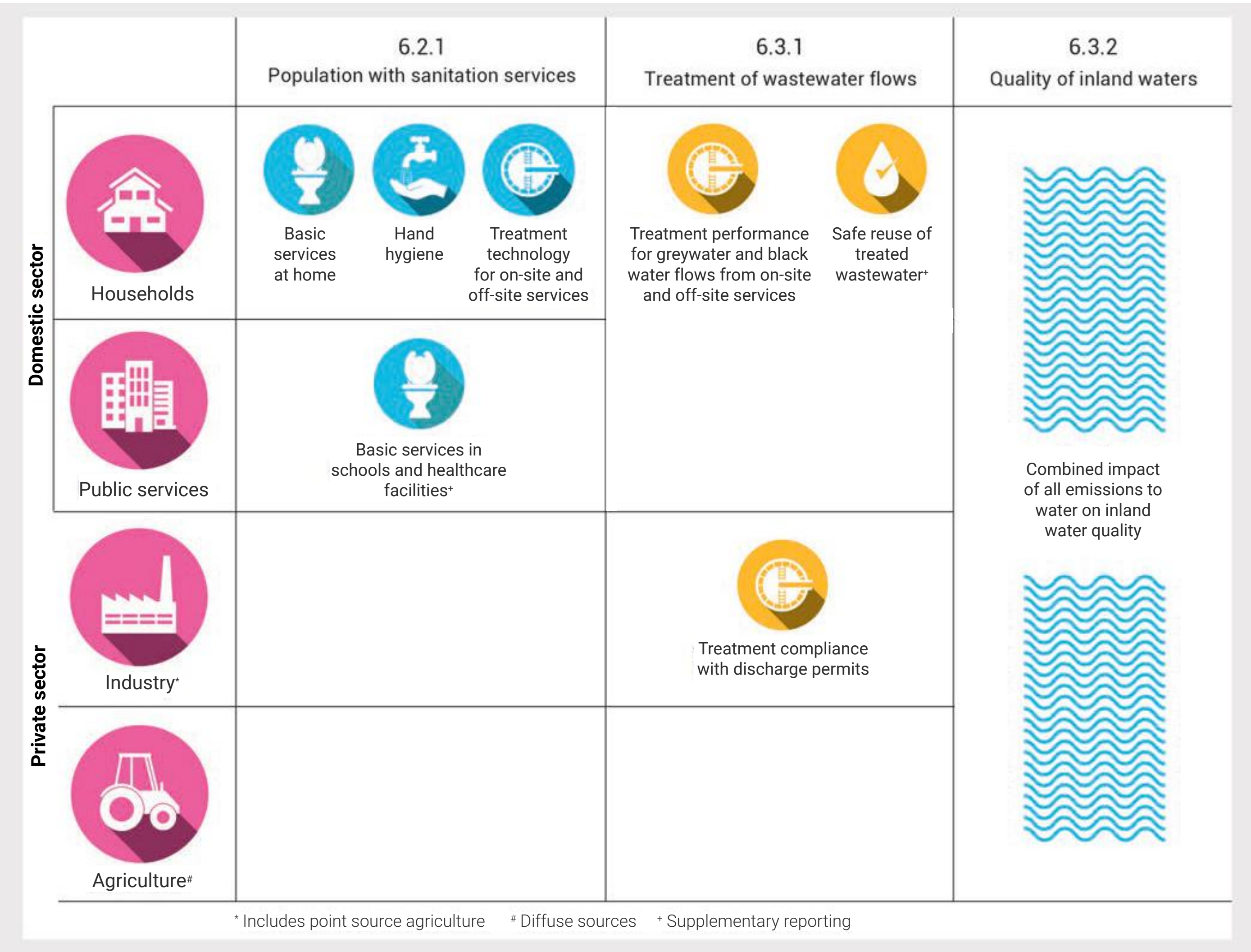
Target 6.3 calls for countries to halve the proportion of untreated wastewater, to increase wastewater collec-

Children fish in the river in Pibor, South Sudan. Photo: UN Photo/Nektarios Markogiannis tion and to ensure that on-site and off-site treatment technologies are in use and maintained, ensuring that effluent consistently meets national standards. Industrial wastewater generators need to be monitored and regulated by means of permits for discharging into sewers and/or the environment. Removing hazardous pollutants at source and safely treating wastewater create opportunities for increasing the safe reuse of water to combat water scarcity. These actions also help realize the human right to water and sanitation, and in particular, the right not to be harmed by unmanaged faecal waste.

Progress on SDG target 6.3 partly relies on progress towards universal access to sanitation (indicator 6.2.1), improvement in domestic wastewater treatment, industrial wastewater source control and treatment (6.3.1) and reducing diffuse pollution from agriculture. Diffuse pollution is more difficult to monitor and future methodologies need to account for how this contributes to pollution, together with point sources, based on the most recent research in this area. Indicator 6.3.2 assesses the combined impact of all wastewater discharges (including diffuse agricultural run-off not covered in 6.3.1) (Figure 1). Water quality is also one of the future sub-indicators of indicator 6.6.1 on water-related ecosystems.

National progress towards achieving target 6.3 cannot be measured without the information provided by indicator 6.3.2. To be able to improve water quality, a benchmark is needed. Without this means of comparison, efforts to eliminate dumping, minimize the release of hazardous chemicals and materials, and tackle wastewater treatment and reuse will go undetected, and their success or failure will be unknown. Indicator 6.3.2 provides a benchmark and, over time, with continuous monitoring, allows progress to be tracked.

Figure 1: Linkages among indicators on sanitation, wastewater and water quality



Source: World Health Organization (from United Nations, 2018).

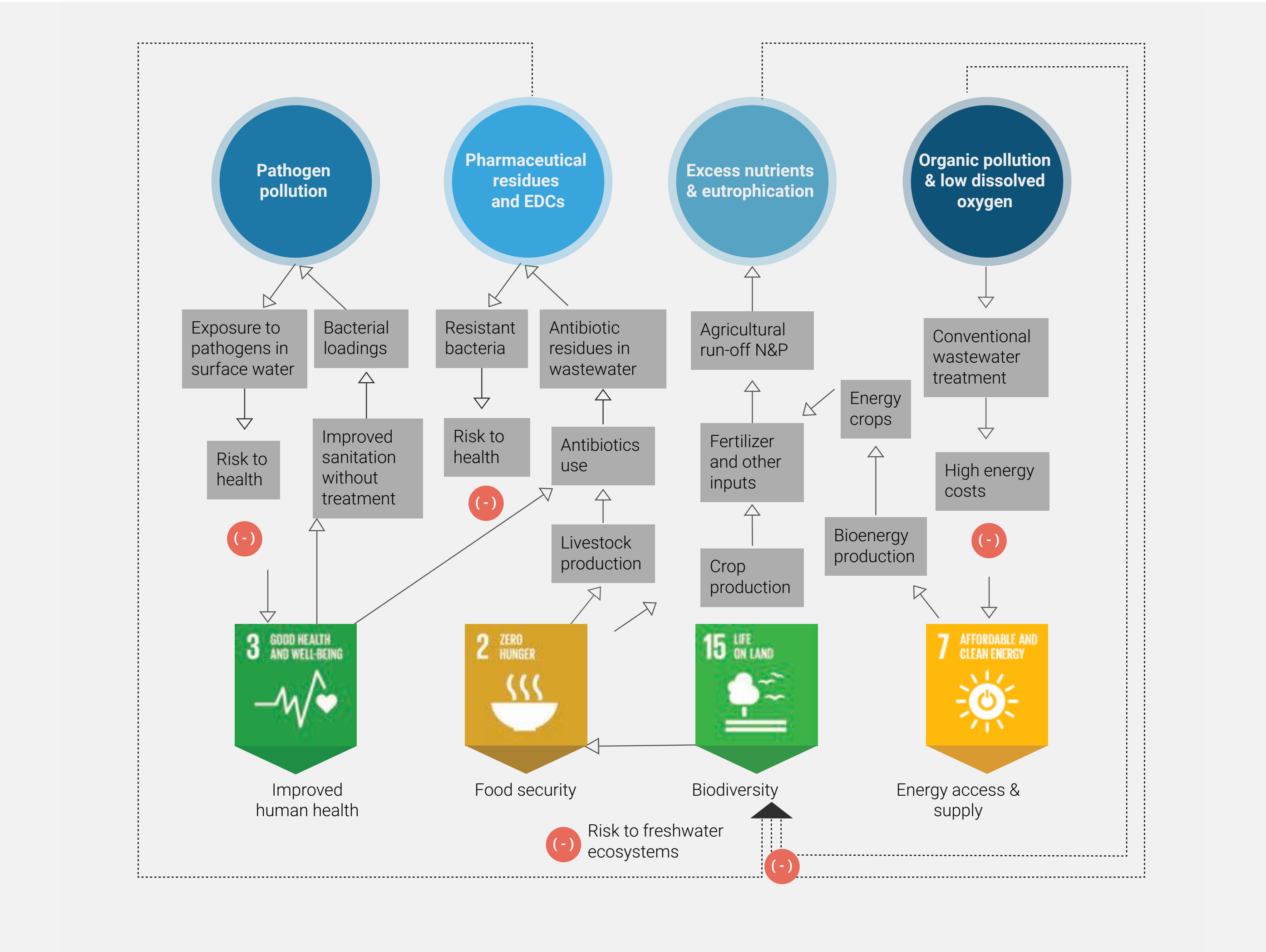
1.4. Interlinkages with other SDGs

Indicator 6.3.2 is a key indicator of the SDGs; its importance extends beyond its associated target to many other SDGs. Within target 6.3, indicator 6.3.2 is directly linked to indicator 6.3.1 on wastewater treatment because inadequate wastewater treatment leads to degradation in the quality of the waters receiving the wastewater effluents. Indicator 6.3.2 is strongly linked to target 6.1 (access to safe drinking water) and target 6.6 on water-related ecosystems. Indicator 6.6.1 directly incorporates the output of indicator 6.3.2 as a sub-indicator. Many other SDGs rely on good ambient water quality, whether directly or indirectly. The information from indicator 6.3.2 can inform decisions relating to ending hunger (SDG 2), improving health (SDG 3), increasing access to energy (SDG 7), promoting sustainable tourism and industrialization (SDGs 8 and 9), reducing marine pollution (SDG 14) and safeguarding terrestrial biodiversity (SDG 15). Figure 2 highlights these causative links.

1.5. Status of and trends in global freshwater quality

Freshwater ecosystems are some of the most impacted ecosystems worldwide (Revenga and Kura, 2003; Ligtvoet *et al.*, 2018), with population growth and socioeconomic development driving this impact. These drivers account for pressures associated with the discharge of wastewaters, as well as agricultural

Figure 2: Main interlinkages between target 6.3 and other SDGs (non-exhaustive selection, for illustrative purposes)



Source: UN Water, 2016.

Groundwater-controlled corrosion surface, Guizhou Province, China. Photo: Jacob Burke

sources of pollution, such as run-off of fertilizers and pesticides. Agricultural practices may also discharge large quantities of organic matter, pharmaceutical residues, sediments and saline drainage effluent directly into water bodies, with the resultant water pollution posing risks to aquatic ecosystems and human health (UNEP, 2016). In many countries, agricultural sources of pollution pose a greater threat to water quality than municipal and industrial pollution (WWAP, 2017).

The link between water scarcity and water quality is often overlooked. Water pollution, which reduces water quality, decreases the amount of water available for specific needs without requiring significant treatment costs. These water-related issues of scarcity and pollution, along with flooding, are expected to increase in the coming decades if measures are not taken to tackle water security (Ligtvoet *et al.*, 2018).

Two recent reports that summarize trends in global freshwater quality are: *A Snapshot of the World's Water Quality: Towards a global assessment* (UNEP, 2016); and *Transboundary River Basins: Status and Trends* (UNEP-DHI and UNEP, 2016).

A Snapshot of the World's Water Quality: Towards a global assessment uses a "combined data driven/model driven approach" to assess water quality on three continents and makes the best use of both measurement data (GEMStat[1] database) and modelling results (WorldQual water quality model). The report highlights that the cove-

BOX 2

The UN Environment Global Environment Monitoring System for freshwater (GEMS/Water)

GEMS/Water provides the global community with sound data on freshwater quality to support scientific assessments and decision-making on the subject.

Monitoring data on surface- and groundwater quality collected from the global GEMS/Water monitoring network is shared through the GEMStat information system.

GEMS/Water supports SDG 6 in terms of methodology, data management, quality assurance, indicator calculation and capacity development. The programme:

- collects and shares monitoring data on freshwater quality;
- maintains the global water quality information system, GEMStat;
- provides capacity development and training to empower countries to deliver authoritative and reliable data.

[1] GEMStat is the freshwater quality database housed by the International Centre for Water Resources and Global Change within the framework of the GEMS/Water programme. The growing database contains more than 3.5 million entries for rivers, lakes, reservoirs, wetlands and groundwater systems from 75 countries and approximately 3,000 stations.

rage of water-quality data from GEMStat for Latin America, Africa and Asia was "inadequate to assess the scope of the global water quality challenge". For example, the density of water-quality measuring stations in Africa is one hundred times lower than the density elsewhere in the world. There is therefore an urgent need to "expand the collection, distribution, and analysis of water quality data through the international GEMS/Water programme[2] and other activities" (UNEP, 2016).

Beyond identifying the lack of in situ water-quality data, the report highlights several key findings. It estimates that organic pollution affects around one seventh of all river stretches assessed. Organic pollution includes material that depletes the oxygen concentration in water as it decomposes and has a direct impact on inland fisheries. Severe pathogenic pollution, which is linked to the occurrence of waterborne diseases, is estimated to affect one third of all river stretches in the study. The report findings indicate that the impact on humans could be in the hundreds of millions, with women and children being disproportionately affected. The report identifies wastewater loadings as the immediate cause of increasing water pollution, with economic activity, intensification of agriculture and an increase in inadequately treated sewage being drivers. For countries that rely on ecosystem services provided by large lakes, such as the Great Lakes of Africa, excessive anthropogenic inputs of phosphorus, which is often the limiting nutrient in freshwater systems, is accelerating eutrophication and disrupting the lakes' natural processes, ultimately hindering the provision of ecosystem services.

The *Transboundary River Basins: Status and Trends* report provides a comprehensive assessment of the world's 286 transboundary river basins, which cover nearly half of the world's land surface (UNEP-DHI and UNEP, 2016). The report covers a broad spectrum of issues, including natural and social issues as one of the five themes focusing on water quality. The main relevant findings on water quality correspond with those in the *Snapshot of the World's Water Quality* report, identifying that the water quality of transboundary river basins is at risk. The report concludes that water quality is severely affected in more than 80 per cent of the basins studied; nutrient enrichment was deemed the main risk in developed nations and pathogens in developing nations, while several emerging economies were at risk from both types of pollution. Moreover, water-quality risks are projected to increase in most basins in the coming decades.

The relative importance of groundwaters and surface waters differs globally. The data void apparent for surface waters holds true for groundwaters also, and is compounded by the greater level of technical expertise required to collect, assess and interpret these data correctly. Efforts to provide a global picture of groundwater quality have been inconclusive (UNESCO-IHP and UNEP, 2016), and are hampered by the fact that groundwater, by its very nature, is hidden. Groundwater monitoring programmes require the same elements as surface-water monitoring programmes, but with greater expertise to implement them. In addition, the results are more difficult to interpret. This is compounded by a shortage of qualified groundwater specialists and experienced well-drilling technicians in low- and middle-income countries; as such, efforts are needed to address this capacity deficit (IAH, 2017).

Groundwater bodies need to be recognized as receiving water bodies that require protection against polluting discharges and inappropriate land use. Once polluted, there is a potential for groundwater resources to remain so for decades, or even centuries, hence the importance of implementing effective groundwater monitoring programmes. Groundwater flow systems are often very heterogeneous, meaning that samples from wells in close proximity may produce very different results, especially if they are taken from different depths. Additionally, groundwater monitoring results are strongly influenced by sampling methods and protocols; field personnel therefore need to be trained to a high level to ensure that they can obtain representative samples. In addition to routine monitoring, extensive experience gained from other regional and national groundwater monitoring programmes clearly illustrates that to reliably interpret groundwater status and trends, periodic intensive surveys need to be carried out on a systematic, aquifer-by-aquifer basis. This interpretation requires supporting data on anthropogenic pressures and aquifer dynamics, as well as regular monitoring of a few selected, long-term monitoring stations to improve interpretation (IAH, 2017).

[2] The UN Environment GEMS/Water programme is the Global Environment Monitoring System for freshwater. The programme collects and shares water-quality data for assessment through GEMStat and provides capacity development on the monitoring and assessment of freshwater quality.

2

Monitoring ambient water quality in the SDGs

A disease detective in Uganda takes water samples to test for water-borne disease. Photo: Center for Disease Control and Prevention (CDC)

This section highlights the importance of monitoring water quality and discusses the development of the methodology and the feedback received from countries that have engaged with the process so far.

2.1. Monitoring ambient water quality

Water quality is defined by the characteristics, or properties, of the water. These characteristics can be physical – such as temperature and chemical measurements concerning the concentration of certain compounds – or biological – for example, the presence or absence of certain species that have known tolerances to pollution. These characteristics govern water's suitability for different uses. Drinking water, for example, should have low levels of pathogens and toxins; irrigation water should be low in salts; water for certain industrial processes should be low in suspended materials; and the aquatic ecosystem requires water with natural oxygen and nutrients, a low level of suspended solids and no (or very low levels of) toxic substances.

Monitoring refers to the systematic collection of data over temporal or spatial scales, with these scales dependent on the monitoring programme objectives. For example, the spatial and temporal resolution of data collected as part of a monitoring programme aiming to understand national ambient water quality will contrast sharply with that of a programme designed to map the intensity and extent of a chemical spill following an industrial incident. All monitoring programmes, regardless of their objectives, require the collection and analysis of water, sediment or biota samples. Analysis may be done either at the sample site or in a laboratory, depending on the parameter being measured. Monitoring programmes also require a data management infrastructure for collation, storage, analysis and dissemination of water-quality data.

Determining water quality at the national level requires a network of monitoring stations that covers all water bodies, which may include both surface- and groundwaters. The analysis of certain water-quality parameters is time-dependent and transportation of samples to laboratories within these time constraints is not always possible from remote locations; in these situations, analysis in the field may be the only suitable option. For example, the analysis of water temperature is meaningless if performed in a laboratory several hours after the water sample has been collected, and therefore must be performed on site. This is also true,

KEY FACTS

The five core parameters of indicator 6.3.2 can all be **measured using a range of inexpensive and simple field techniques**, accessible to citizen science networks.

Poor data management and data access still prevent collected data from being used to their full potential.

Emerging contaminants of concern such as pharmaceuticals and personal care products, which are increasingly being dispersed in the environment, are posing a largely unmonitored problem to both surface- and groundwater water quality.

although to a lesser degree, for many water-quality parameters. Some parameters can be “fixed” at their in situ value by the addition of preservatives to the sample; the sample can then be analysed at a later date with no change to the concentration of the target parameter. The core parameters chosen for indicator 6.3.2 can all be analysed in the field using either sensors or field kits, thereby removing this constraint, although laboratory analyses in a controlled environment often lead to better results since they can detect lower concentrations, and therefore have better accuracy and precision.

The progressive monitoring approach for indicator 6.3.2 is divided into two levels:

- The global indicator, which uses a water quality index, comprises core physico-chemical water-quality parameters (Table 1). This is the level at which countries were asked to report during the 2017 data drive.

- The progressive monitoring level, which includes monitoring of additional parameters and approaches such as biological, microbiological or Earth observation techniques.

Many countries use biological and ecological approaches to monitor water quality, and some of these have been modified and improved over many years (e.g. Dickens and Graham, 2002; WFD-UKTAG, 2014). In a few countries, the results of biological approaches are combined with physical and chemical measurements to obtain an overall judgement of water quality (EPA, 2008). All countries are encouraged to consider developing a biological system, where resources allow, and to include such methods when assessing the water quality of rivers and lakes. No single biological method has been tried and tested at a global level, but there are some general approaches that can be followed to develop indices that are useful for the spatial or temporal evaluation of water quality (Chapman and Jackson, 1996).

Earth observation data is increasingly being used for water-quality monitoring, however, it is currently limited to optically detectable water-quality parameters, such as turbidity and chlorophyll, and only in relatively large bodies of water, such as lakes and wide rivers. Given the high spatial and temporal resolution of current and upcoming satellite missions, Earth observation data could prove to be an important and cost-effective additional data source for monitoring large rivers and lakes in the near future.

There is significant interest in the potential of citizen science (e.g. FreshWaterWatch)[2] to deliver greater spatial coverage of water-quality monitoring data than that which is possible with traditional, laboratory-based monitoring networks. The five core parameters of indicator 6.3.2 can all be measured using a range of inexpensive and simple field techniques, accessible to citizen science networks. Thus, where data submission can be captured electronically by the responsible organization, these networks may serve as a useful additional source of data for indicator 6.3.2. Citizen science projects should be well designed to ensure success in addressing the water-quality data gap. It is recommended that training be provided to the citizen groups and that data collection and analysis be coordinated and officially approved by a designated central organization.

Table 1: Core parameters for the three water body types

	Parameter	River	Lake	Groundwater
Core parameter	Dissolved oxygen	x	x	
	Electrical conductivity	x	x	x
	Total oxidized nitrogen	x	x	
	Nitrate*			x
	Orthophosphate	x	x	
	pH	x	x	x

**Nitrate is suggested for groundwater due to associated human health risks.*

[2] https://freshwaterwatch.thewaterhub.org/

2.2. Developing the methodology

The development of the methodology builds on best practice for water-quality monitoring promoted by the UN Environment GEMS/Water programme since 1978. The methodology is based on a water quality index developed in 2007, which was revised in 2014/15 specifically to meet the needs of indicator 6.3.2. In 2016, as part of the Integrated Monitoring Initiative[3] coordinated by UN-Water, the proposed index 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. Only three of these countries attempted to implement the methodology; another had the necessary data but needed additional time to compile the index. In parallel to the proof of concept testing, feedback was obtained from numerous individual experts and international organizations 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. This revised version was subsequently applied globally in 2017 as part of the first SDG 6 data drive. The submissions received, and the further feedback acquired during this period from multiple countries, form the basis of this report.

2.3. Summary of 2017 feedback

Opportunities were taken to promote indicator 6.3.2 and to disseminate details of the methodology, both prior to and throughout the 2017 data drive, at numerous international events. In addition, a targeted engagement strategy was employed under the UN-Water Integrated Monitoring Initiative, which included webinars, a help desk and country visits. Most notably, the UN-Water Global Workshop for Integrated Monitoring of Sustainable Development Goal 6 on Water and Sanitation, held in The Hague, the Netherlands, in November 2017, provided the opportunity to discuss the methodology in a “market stall” environment with countries that had attempted to implement the methodology. The purpose of the market stall was to present and discuss the indicator and the results received in 2017 with country representatives and other interested parties. The discussion highlighted the need for capacity development to deliver effective water-quality monitoring programmes that can generate sufficient data to meet reporting requirements for indicator 6.3.2. These capacity development efforts include training, resource support and more comprehensive support – such as detailed guideline documents – on the specifics of the methodology.

A boy drinks a bowl of water in Tora village, 50 km north of El Fasher, North Darfur. Photo: UN Photo/Albert González Farran

[3] http://www.sdg6monitoring.org/

Table 2: Opportunities to receive feedback during development of the methodology

Feedback opportunity	Details
Workshops	• GEMS/Water, *Ambient water quality: monitoring for management* – Nairobi, Kenya, November 2016 (13 countries) • UNESCO, *Regional Expert Meeting on Water Quality in Agenda 2030 SDGs* – Abuja, Nigeria, December 2016 (8 countries and 8 river basin organizations) • GEMS/Water, *Ambient water quality: monitoring for management and SDG indicator 6.3.2* – Brasilia, Brazil, January 2017 (12 countries) • AMCOW – Accra, Ghana, May 2017 (42 countries) • GEMS/Water, *Ambient water quality: monitoring for management and SDG Indicator 6.3.2 Reporting* – Bangkok, Thailand, November 2017 (17 countries) • UN-Water, Global workshop for integrated monitoring of Sustainable Development Goal 6 on water and sanitation – The Hague, the Netherlands, November 2017. Presentations on indicator 6.3.2 and "market stalls" (75 countries) • CEDARE, Cairo, Regional Meeting on the 3rd Arab State of the Water Report – Cairo, Egypt, November 2017. Training session on SDG Indicator 6.3.2 (13 countries)
Country visits	Uganda, 2016; Kenya, 2016; Zambia, 2016; Malawi, 2016; Lesotho, 2016; South Africa, 2016; Mozambique, 2017; Ethiopia, 2017; Tanzania, 2017; Cameroon, 2017; Peru, 2017; Fiji, 2017; Senegal, 2017; Jamaica, 2017
Conferences	• Africa Water Week, Dar es Salaam – Tanzania, July 2016 • Second Session of the UN Environment Assembly, Side Event – Nairobi, Kenya, May 2016 • 4th Arab Water Forum – Cairo, December 2017 (Presentation on SDG indicator 6.3.2 during Special Session 5: Arab State of the Water and Sustainable Development)
Live webinars	Eight live webinars across three time zones (translated into all United Nations languages – recordings made available through UN-Water website)
Proof of Concept countries	Uganda, the Netherlands, Senegal, Peru and Jordan provided feedback that was taken into consideration in the January 2017 revision
International reviews	Numerous international experts and organizations between August and October 2016
Feedback questionnaires	Questionnaires circulated among Member States following the 2017 data drive to collect updated feedback on experiences and challenges in 2017/18 (see below)

2.3.1. Summary of questionnaire feedback

Following the completion of the 2017 data drive, two questionnaires were circulated by the 6.3.2 task team to capture responses from two cohorts: Questionnaire 1 was circulated among Member States that reported for the indicator and Questionnaire 2 among those that did not report.

Responses to Questionnaire 1 (countries that reported for indicator 6.3.2) were received from 29 respondents from all world regions. The key findings are summarized below:

- 75 per cent[4] (18 of 24 respondents) felt that SDG indicator 6.3.2 characterizes the status of ambient water quality in their country. Some felt that the indicator did not include certain parameters that would describe water-quality pressures in their country more appropriately, such as microbiological parameters or heavy metals.

[4] Percentages quoted correspond to the number of respondents for that particular question, rather than all questionnaire respondents. Some respondents did not answer all questions.

- 83 per cent (20 of 24 respondents) felt that the indicator was globally applicable, but some respondents felt that allowing countries to set their own target values reduced the global comparability of the indicator. For example, neighbouring countries setting different target values for the same transboundary water body would lead to different conclusions on what could be the same water quality.

- 70 per cent (19 of 27 respondents) identified financial constraints as limiting effective water- quality monitoring in their country. Other major constraints identified included technical expertise, laboratory facilities and equipment, data storage and handling expertise.

- 56 per cent (14 of 25 respondents) – mainly in less developed countries – felt that ambient water quality was not sufficiently monitored in their countries to fulfil indicator 6.3.2 reporting.

- Awareness of all the materials (written methodology, webinars, online tutorial, help desk) available to support submissions was low: 31 per cent (8 of 26 respondents) were not aware of the written methodology, yet still reported data. This suggests that reporting requirements need to be better publicized for future data drives. Several respondents requested further training, and comments were raised regarding improving engagement on a national and regional basis.

- Efforts to align the hydrological reporting units within transboundary countries relied mainly on existing transboundary arrangements, such as river basin organizations, or reporting frameworks, such as the EU WFD.

- Coordination on target values for transboundary water bodies was also limited to existing frameworks.

- Of the five core parameters, it was the nutrients (nitrogen and phosphorus) that failed to meet their targets more often than any of the other three (pH, conductivity and dissolved oxygen). This either suggests that the targets were more relevant for the nutrients or that nutrient pollution is driving the indicator scores.

- 87 per cent (13 of 15 respondents) felt that an “improving versus degrading” assessment of water quality, as opposed to measuring against a numerical target value, would be a more useful approach.

- 67 per cent (10 of 15 respondents) felt that the hydrological reporting units and water bodies should not be stipulated by UN Environment, and that it would be better to use existing units, although several noted that for transboundary waters, this would indeed be useful.

Responses to Questionnaire 2 (countries that did not report for indicator 6.3.2) were received from 47 respondents from all world regions. The purpose of this survey was to ascertain why countries failed to report. The key findings are summarized below:

- 63 per cent (10 of 16 respondents) stated that ambient water quality was not monitored in their country and as such, reporting on indicator 6.3.2 was not possible.

- Other main reasons for why countries failed to report were identified in equal number: ambient water quality is monitored, but data were not available (inaccessible) for reporting; incompatibility of existing monitoring framework; the request to report did not reach the correct person; methodology requirements were not understood; insufficient time to report; insufficient human resources; insufficient financial resources.

2.4 Details of methodology

Indicator 6.3.2 relies on water-quality data derived from in situ measurements and the analysis of samples collected from surface- and groundwaters. Water quality is assessed by means of core physical and chemical parameters that reflect natural water quality – related to climatological and geological factors – together with major anthropogenic impacts on water quality. The measured values are used to classify water quality as either “good” or “not good” in relation to numerical target values, by combining the scores into a water quality index. A threshold value of 80 per cent compliance is defined to classify water bodies as good quality. Thus, a body of water is classified as being of good quality if at least 80 per cent of all monitoring data from all monitoring stations within the water body comply with the respective targets.

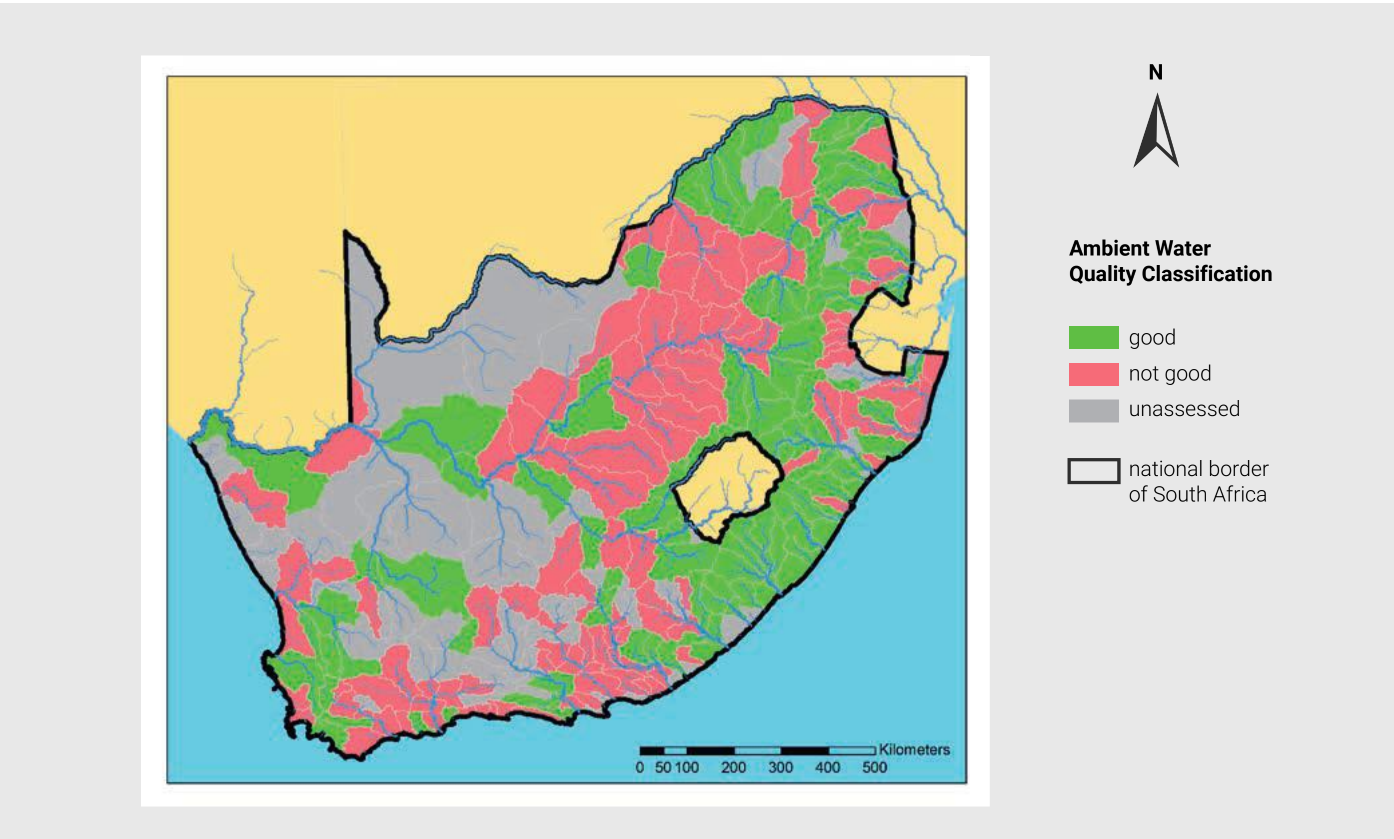
Figure 3 below shows an example map produced using real-world data submitted by South Africa in 2017, illustrating the detailed information that can be provided by the indicator. It shows the areas where water quality failed to meet the criteria for good ambient water quality (red) and where it did (green). Grey areas signify water bodies for which insufficient data were available during the assessment period for the 2017 reporting period.

The methodology uses a water quality index that combines data from the analysis of basic core water-quality parameters. Some of these parameters are direct measures of water quality for ecosystem or human health, while others are included to characterize the water quality at the site. Deviation from normal ranges (in the case of electrical conductivity and pH), or values that exceed (phosphate and nitrogen) or fall below (dissolved oxygen) expected target values, may be symptomatic of impacts on water quality.

All SDG indicators are reported at the national level, but additional subnational reporting units are used for some indicators to produce more meaningful units of disaggregation. The reporting units for indicator 6.3.2 were aligned with those for indicator 6.6.1 on the extent of freshwater ecosystems. For these indicators, reporting units based on river basins were used as the unit of disaggregation from national reporting. This is preferable because it helps to discern spatial patterns across a country. Furthermore, for indicator 6.3.2, each river basin has been subdivided into smaller hydrological water body units that help illustrate intra-basin patterns in water quality. The river basin approach is beneficial for the integrated management of water resources, especially for those crossing international borders. The concept, which is used in the implementation of the EU WFD, provides a more useful unit for assessing water quality and a basis for applying management measures.

For this initial SDG indicator 6.3.2 data drive, launched in 2017, Member States were asked only to report on the core physico-chemical parameters (Level 1 monitoring). The written methodology document prescribed a progressive monitoring approach, including monitoring of additional parameters such as biological and microbiological, but these were not requested during the data drive.

Figure 3: Example of information provided by SDG indicator 6.3.2



Data source: Water Management System database, Resource Quality Information services, Department of Water and Sanitation. Contact: Michael Silberbauer. Data supplied for 2017 SDG indicator 6.3.2 data drive

BOX 3

The core parameters and why they are important

Dissolved oxygen is important for aquatic organisms. Levels of dissolved oxygen fluctuate naturally with temperature and salinity. Turbulence at the surface of a river, at riffles or at waterfalls can increase the concentration of dissolved oxygen. Photosynthetic activity of aquatic flora and respiration by aquatic organisms can also affect concentrations, diurnally and seasonally. Very low oxygen concentrations may suggest the presence of biodegradable organic matter, such as sewage. Ideally, dissolved oxygen is measured in situ using an oxygen probe, but methods are also available whereby the oxygen in the water sample is chemically fixed for analysis in the laboratory.

Electrical conductivity is a simple measure of dissolved substances, such as salts, that help characterize the water body. Values of electrical conductivity change naturally, especially during periods of increased flow. Electrical conductivity is included as a core parameter because it is simple to measure and because deviation from normal ranges can be used as an indicator of pollution, such as wastewater inputs into the water body. The most accurate method of measuring electrical conductivity is by using a conductivity probe in situ because values can change during the time between collection in the field and analysis in the laboratory.

pH is included as a core parameter because, like electrical conductivity, it is useful for characterizing the water body. pH is one of the most widely measured parameters due to its influence on many biological and chemical processes. It is a measure of the activity of the hydrogen ion in the water, which can fluctuate naturally, especially with changing hydrological conditions that are influenced by groundwater, subsurface flows and surface run-off during rain events. Changes outside of natural ranges indicate possible pollution from industrial or other wastewater sources. pH is most accurately measured in situ using a potentiometric probe because values can change during the time between collection in the field and analysis in the laboratory.

Orthophosphate is a bioavailable, dissolved, inorganic form of phosphorus, which is an essential nutrient for aquatic life. Additional inputs from human activities, such as wastewaters or agricultural run-off, can increase concentrations such that they support excessive plant and algal growth, which affects the ecological balance of the aquatic ecosystem and impairs water quality for human use. Orthophosphate can be measured in the field using test kits, but the most accurate results and limits of detection are achieved in the laboratory. Concentrations of orthophosphate can change over time if the sample is not fixed; it is therefore recommended that samples are analysed within 24 hours.

Total oxidized nitrogen (TON) is a combined measure of both nitrate and nitrite, which are both forms of dissolved inorganic oxidized nitrogen. Like phosphorus, nitrogen is a nutrient essential for aquatic life, but additional inputs can have detrimental impacts on freshwater ecosystems. TON, rather than nitrate, is suggested because the analytical method is more straightforward and does not involve the additional analysis of nitrite needed to measure nitrate alone. In most instances, the nitrite fraction of TON in surface waters comprises less than 1 per cent of the total, so for practical purposes, TON and nitrate are considered the same. As with orthophosphate, there are kits available for in situ monitoring of TON.

Note on nutrient analyses – There are many fractions of phosphorus and nitrogen that countries may already be routinely monitoring, including inorganic, organic, particulate and dissolved forms. For example, total phosphorus can be a more useful measure of water quality affected by wastewater discharges than orthophosphate, but it is more complex to measure because a digestion phase is required during analysis. Countries can choose to measure the fraction that is most relevant in the national context, but orthophosphate and TON are included here as recommendations for the global indicator. Moreover, for groundwaters, it is specifically nitrate that is included as the core parameter, rather than any other fraction of nitrogen, due to the associated human health risk of drinking water with high nitrate concentrations.

The core parameters cannot fully represent all pressures on water quality. For example, certain countries may undertake significant mining activities, in which case the monitoring of heavy metals would be critical to monitoring the impacts of these activities. As heavy metal pollution from mining is not an issue in all countries, heavy metals are not accounted for in the global indicator. Another regional issue for groundwaters in particular is the naturally high concentrations of arsenic in groundwater. The progressive monitoring steps outlined in the methodology ensure that it is possible to balance global and national relevance in future data drives. Monitoring the core parameters provides the framework upon which more targeted monitoring programmes can be built, such as the monitoring of heavy metals, which fulfil the requirements of national water-quality assessment and reporting.

2.5. Global and national relevance of methodology

Efforts to report on indicator 6.3.2, by requesting Member States to submit aggregated water-quality data, are an ambitious attempt to build a picture of the status of global freshwater quality based on in situ data. As highlighted in section 3, the current status of the world's freshwaters is largely unknown, despite decades of attempts to fill this data void. The density of monitoring stations is often far too low to be able to fully assess water quality (UN-Water, 2016). Understanding and addressing the challenges faced by countries during the 2017 data drive provides opportunities for developing the methodology to facilitate achieving target 6.3 and reaching SDG 6.

The data drive has helped build a picture of where monitoring activities are strong and where they are lacking. It has also helped identify ways in which the methodology can be made more flexible to facilitate more data flows for building a global understanding of water quality. In some countries, it was noted that data were being collected but were not available for assessment and reporting; instead, they were remaining in data silos. This situation has been recognized for decades (Ward *et al.*, 1986), and yet today, poor data management and data access still prevent collected data from being used to their full potential. Indicator 6.3.2 has provided the platform, at the global level, to lever any available data into the reporting framework. For those countries where data do not exist or are of insufficient quality, their monitoring activities are now better understood, and work can and should begin on addressing the capacity deficits that hindered reporting.

The global indicators have a well-defined scope for informing on national progress towards achieving targets. However, for individual countries, they can only serve as the initial step towards building a specific monitoring framework to inform management at the local or subnational level. The indicator framework foresees countries developing their own national and complementary indicators that will be meaningful in their specific context. The methodology framework, which is critical to supporting global reporting, can be adapted and expanded to address relevant regional, national and subnational questions. Monitoring networks designed for indicator 6.3.2 reporting can be adapted to address national issues. If a country is reporting the core parameters for indicator 6.3.2, it will already have basic information on water quality and can therefore easily augment the SDG monitoring programme to gain information relating to nationally relevant water-quality pressures. For example, emerging contaminants of concern such as pharmaceuticals and personal care products, which are increasingly being dispersed in the environment, are posing a largely unmonitored problem to both surface- and groundwater water quality. A country may seek information on the concentrations and extent of these emerging contaminants in their waters by analysing target parameters based on samples collected within the existing monitoring programme.

Indicator 6.3.2 is important in addressing transboundary water-quality issues and helps 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 build a consolidated picture of the world's 286 transboundary river basins. Similarly, for groundwaters, by measuring and comparing water quality in these water bodies, the shared impact and benefits can be understood. The methodology data-reporting template incorporates a transboundary element by requesting countries to identify shared river basins. This approach, which is currently only shared with indicator 6.6.1, would benefit all SDG 6 indicators by enabling more effective management of water resources.

3

Global and regional progress on SDG indicator 6.3.2

Contaminated water in Karial slum, one of the urban slums of Dhaka. Photo: UN Photo/Kibae Park

This section summarizes the progress made on implementing indicator 6.3.2 to date and presents analyses of the submissions received during the 2017 data drive.

3.1. Summary of data drive process

The revised and tested indicator methodology was globally rolled out in 2017, resulting in submissions from 52 of the 193 Member States. It adopted a data drive approach combined with indicator 6.6.1 since both indicators share a common reporting unit – the reporting basin district (RBD). In addition to the indicator 6.3.2 methodology document, a combined reporting template to capture data for both indicators was sent to contact persons in each Member State. To aid countries in their reporting efforts, support and resources were made available through UN Environment. A help desk coordinated by the Freshwater Ecosystems Unit of UN Environment, and supported by the three GEMS/Water centres involved in the 6.3.2 task team, answered 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 certain aspects of the methodology. The GEMS/Water Capacity Development Centre created two online tutorials: one outlining the step-by-step methodology and the other providing more detailed technical information. Lastly, countries could request a country visit, organized through UN Environment, to lead them through the reporting process. All resources were made available through the UN-Water website.[5]

Indicator 6.3.2 differs from many other SDG indicators in that it relies on an operational water-quality monitoring programme in countries, together with reporting and database structures at the national level that enable the water-quality data to be collated centrally for indicator calculation. The reporting template supplied to countries required the submission of data aggregated by RBD, rather than the water-quality data itself, which might be considered sensitive information by some countries that would not wish to disclose this data. Along with the aggregated data, certain metadata were requested to help provide information on the reliability of the indicator reported.

KEY FACTS

The revised and tested indicator methodology was globally rolled out in 2017, resulting in submissions from **52 of the 193 Member States.**

Transboundary and regional monitoring and reporting programmes play an important role in improving the amount and quality of water-quality monitoring data.

Brazil and South Africa are two countries that have established **extensive water-quality monitoring** programmes.

[5] http://www.sdg6monitoring.org/

The variations observed in the submissions received included: the number of monitoring stations used; the number of discrete monitoring values used; the proportion of the country included in the indicator; the assessment period from which data were used; and the number and size of both water bodies and RBDs. These variations in the quality and degree of country reporting were not unexpected. As this was the first time countries had been asked to report, difficulties arose for both highly developed and less developed countries. Many of the least developed countries have limited capacity to operate a monitoring programme to a level that would supply the necessary data for indicator 6.3.2; they also have limited reporting and data structures in place. Conversely, more developed countries, which already collect and report water-quality data nationally and regionally – and often to a much higher level of complexity than required for indicator 6.3.2 – found it difficult to integrate their existing reporting systems with the prescribed reporting structure, within the time available. This was apparent among many of the European Union countries that report water-quality data for the EU WFD, as well as in regular State of the Environment reporting.

To include indicator 6.3.2 as a sub-indicator of indicator 6.6.1, the reporting structures for both needed to be aligned. This was achieved by establishing a common reporting unit, the RBD, for both indicators. For 6.6.1, the indicator per country was the aggregated score for all RBDs, whereas for indicator 6.3.2, the RBDs were further divided into water bodies, with river, open water (lakes and reservoirs) and groundwater bodies delineated within their respective RBDs.

Countries were requested to report only the core five parameters for surface waters (rivers and open water bodies) and three parameters for groundwaters for the 2017 baseline period. The progressive monitoring steps outlined in the methodology, such as including a biological assessment of water quality and data on additional parameters or using more complex classification methods for water quality, were not requested during this baseline phase, so as to reduce the reporting burden on countries.

3.2. Summary of results

During the baseline data drive, 52 countries submitted indicator reporting data with varying levels of data coverage and completeness (for a summary of the reporting data, see table of results in the annex). 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.

3.2.1. Analysis of results

The results of the national indicator scores are depicted in Figure 4, classified into six groups, ranging from very low (less than 10 per cent of water bodies with good quality) to very high (more than 90 per cent of water bodies with good quality) and split by water body types. For groundwater and open water bodies, relatively more countries submitted very low or low indicator values than for river water bodies.

The individual indicator scores ranged between 0 per cent (no water bodies with good quality) and 100 per cent (all water bodies with good quality), with an average score of 65 per cent. The range of indicator scores for the different water body types, and total scores, are shown in Figure 5. For open and river water bodies, the ranges were quite similar, whereas groundwater bodies showed much higher quality. This is partly due to the lower number of groundwater bodies (9,362) being assessed, compared with open water (15,367) and river water bodies (41,131) (see Figure 6). Other reasons for the differences include the smaller number of parameters and the comparatively high target values being used to assess groundwater bodies in many countries, especially for electrical conductivity.

Although no detailed information on individual water bodies was collected, additional information on the size of the RBDs and the number of monitoring stations and monitoring values enabled a superficial analysis of the spatial coverage and representativeness of the reporting data. Figure 7 illustrates the scarcity of data, with some countries basing their indicator calculation on a low density of monitoring stations and monitoring values for a large proportion of the country (large circles, located bottom left). As a result, it is unlikely that the submitted value will reflect the actual water quality, when compared with countries using many stations and monitoring values (top right). Some of the more developed countries used tens of thousands of monitoring records to calculate indicator 6.3.2, while some of the less developed countries with very limited monitoring programmes only reported on a few or a single key water body.

Figure 4: Number of countries that reported indicator 6.3.2 in 2017, split by water body type and aggregated into six quality categories

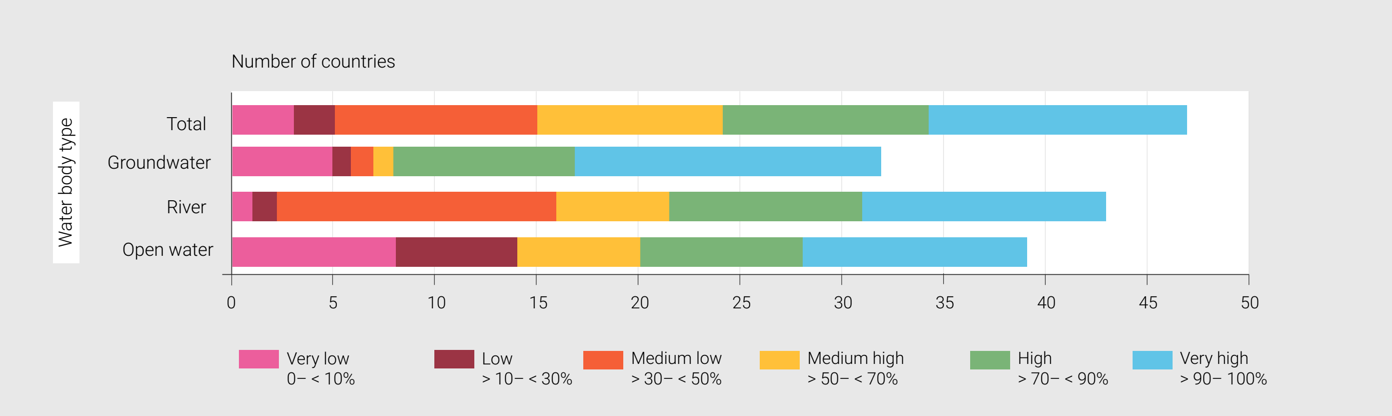


Figure 5: Range of indicator 6.3.2 scores (for 47 countries) reported in 2017, split by water body type and expressed by descriptive statistics (left of box = 25th, notch = 50th and right of box = 75th percentiles)

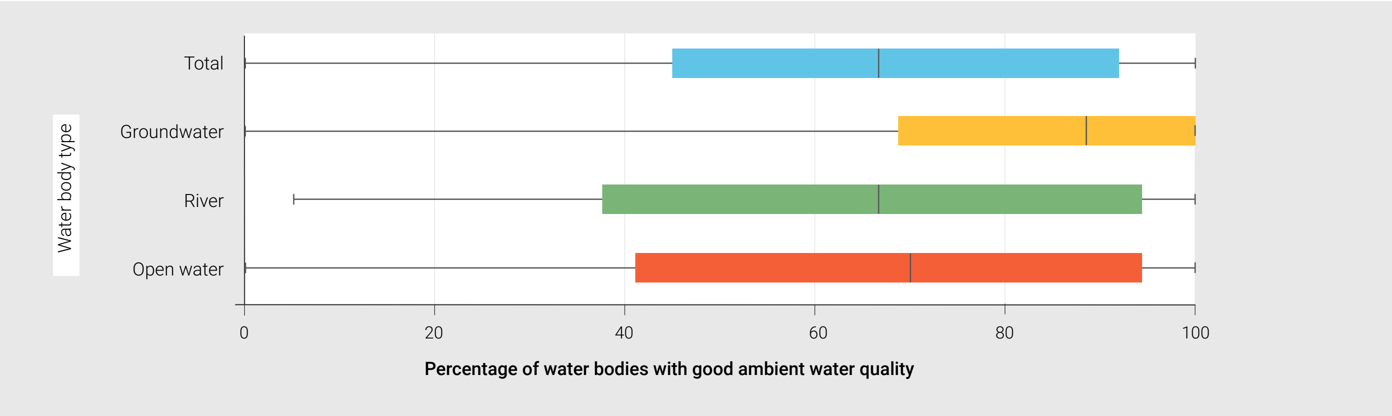
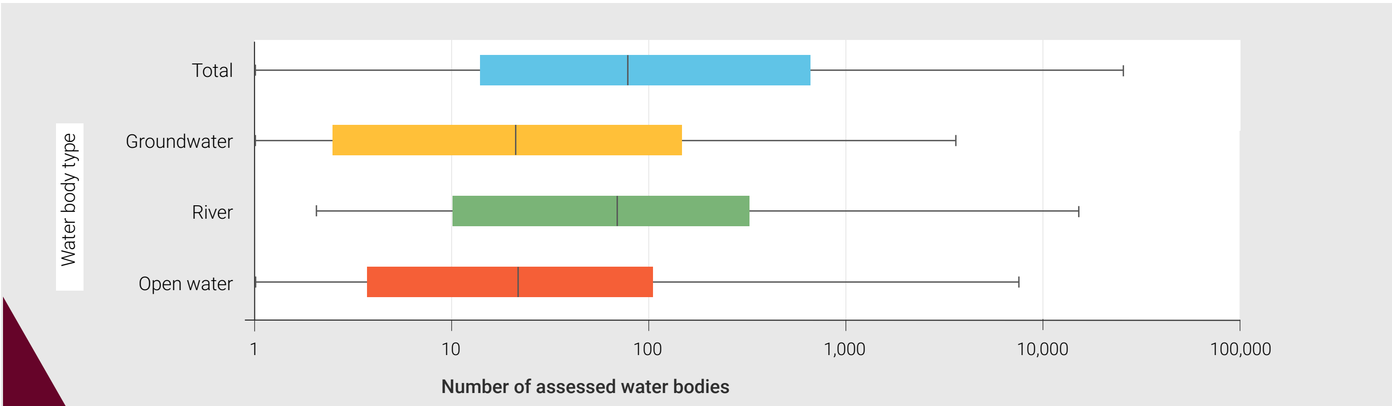
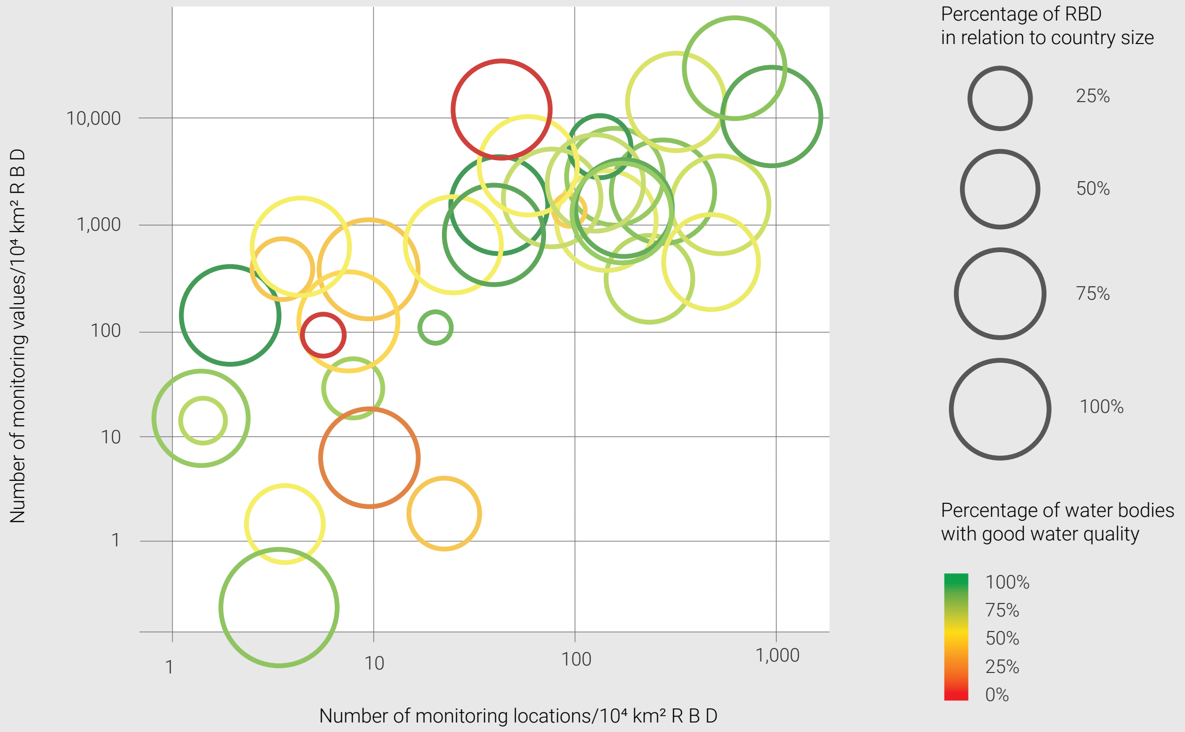


Figure 6: Variation in the number of water bodies assessed for indicator 6.3.2 in 2017 (for 47 countries), split by water body type and expressed by descriptive statistics (left of box = 25th, notch = 50th and right of box = 75th percentiles); X axis is logarithmic



Most of the countries (32 of 47, i.e. 68 per cent) that provided valid indicator data reported that more than half of their assessed water bodies were of good quality (64 per cent for open water bodies, 63 per cent for river water bodies and 78 per cent for groundwater bodies).

Figure 7: Indicator 6.3.2 data submissions for the 2017 baseline data drive, summarized by reported water quality, proportion of country covered, number of monitoring locations and number of monitoring values



Source: International Centre for Water Resources and Global Change.
Notes: RBD is reporting basin district. The circle size relates to the proportion of the individual country covered. The location of the circles indicates the number of monitoring stations and monitoring values used in the indicator calculation in the individual country.

Another important aspect influencing the information gained from the indicator data at the national level, and influencing international comparability, is the water-quality parameters and associated target values being used to assess the quality status of water bodies. The recommended core parameters for surface and groundwater bodies that were used, including the range of related target values, are listed in Table 3. As recommended, most countries used pH, dissolved oxygen and electrical conductivity for their assessments. In terms of nutrient compounds, most countries used nitrate, total phosphorus, orthophosphate and total nitrogen. The related target values, especially for nutrient compounds, demonstrated a wide range with respect to the upper target values, especially those used for groundwater bodies. These upper target values might result from reporting wrong parameter units or incorrect conversion between units; as such, these results should be viewed with caution. Although significant efforts were made to clarify the correctness of the results, not all data submissions could be fully quality controlled due to difficulties in communication with the data analysts.

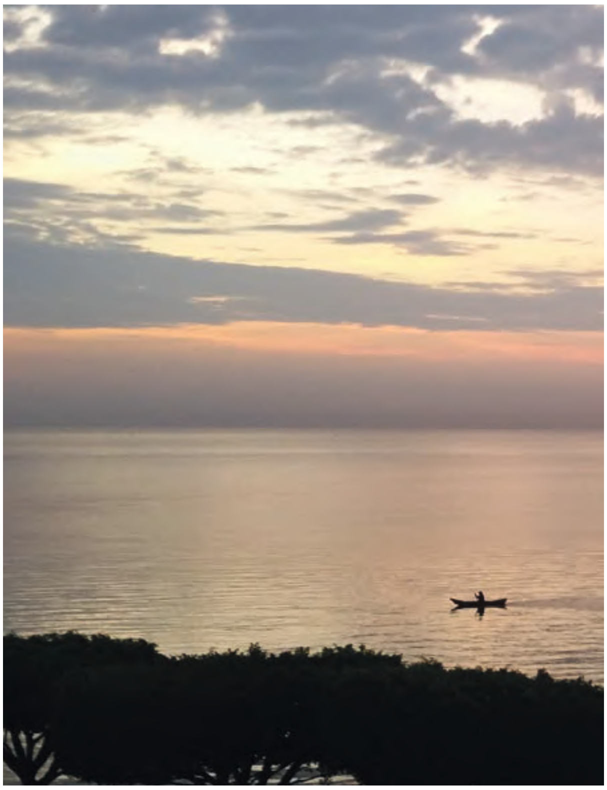
Most countries used national target values based on existing drinking water, irrigation water or ambient water-quality guidelines, where available. European countries that reported during the 2017 data drive, which also report under the EU WFD, mostly reused the WFD target values, aligning both reporting lines and partially reusing the WFD reporting data. Sweden, for example, reused its complete set of WFD reporting data on the ecological status of water bodies, extending the core parameters to include biological and chemical quality elements.

Transboundary and regional monitoring and reporting programmes play an important role in improving the amount and quality of water-quality monitoring data, as well as information products derived from these, available to assess the quality of freshwater ecosystems. During the 2017 baseline data drive, riparian countries of several international river basins in Europe (Danube, Elbe, Ems, Lielupe, Oder and Rhine-Meuse) and in Africa (Limpopo, Nile, Okavango, Orange and Zambezi) reported on their respective parts of these basins.

Table 3: Parameters measured for indicator 6.3.2 and global minimum and maximum target values (n = 40 countries) used in 2017

Parameter name	Target value		Number of countries
	Minimum	Maximum	
Dissolved inorganic nitrogen	0.035	2.5	3
Dissolved inorganic phosphorus	0.035	1.8	1
Dissolved oxygen Dissolved oxygen saturation	0.1 30	19.47 130	32
Dissolved reactive phosphorus/orthophosphate	0	35	13
Electrical conductivity	1	24,000	31
Free ammonia nitrogen/ammoniacal nitrogen	0.0004	3.7	8
Nitrate	0	262.88	20
Nitrate nitrogen	0.01	25	14
Nitrite	0	375	8
Nitrite nitrogen	0.01	0.6	5
pH	3.26	10	35
Total ammonia nitrogen	0.01	175	3
Total dissolved phosphorus	0.04	1.5	2
Total Kjeldahl nitrogen	0.05	7.8	3
Total nitrogen	0.05	35	12
Total oxidized nitrogen/nitrate and nitrite nitrogen	0.4	12.2	4
Total phosphorus	0.005	16	21
Total reactive phosphorus/total orthophosphate	0.006	49.125	7

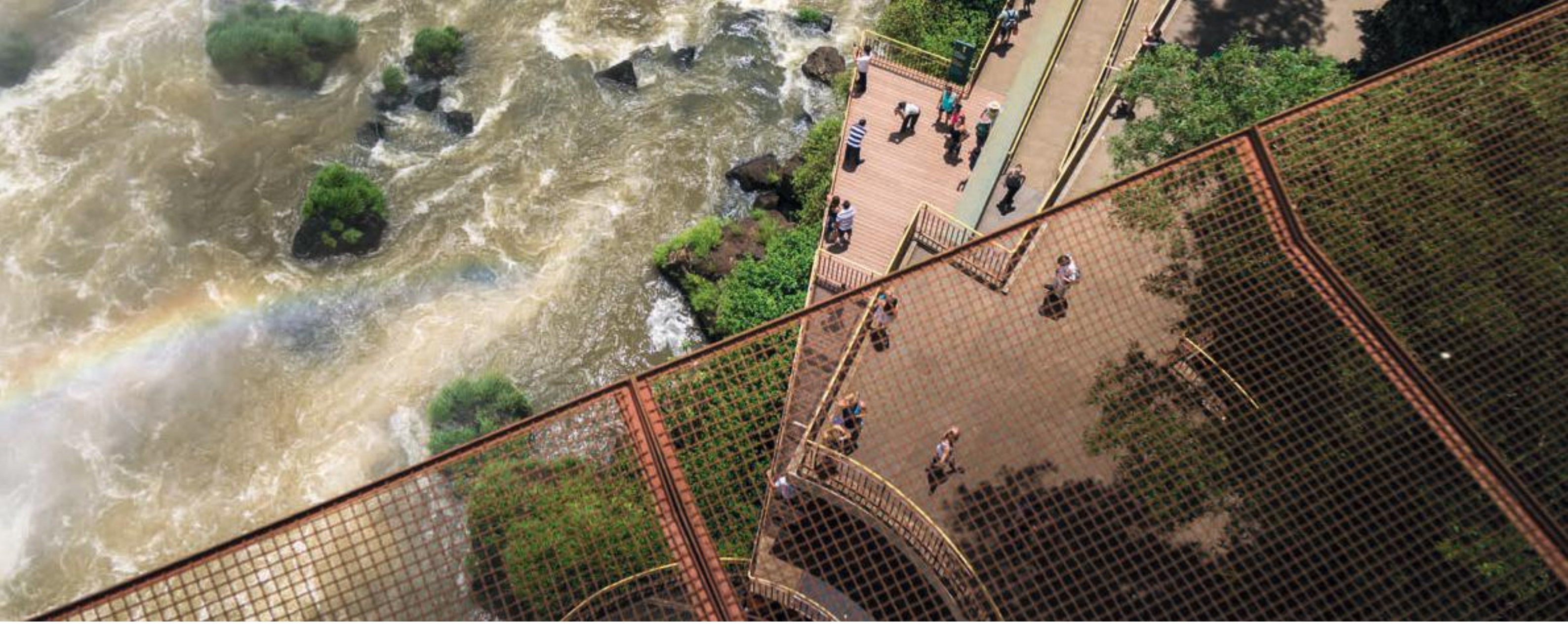
Note: measurement units were not always provided by countries



Sunset on Lake Victoria, Uganda. Photo: GEMS/Water

Due to the basin-focused approach within the WFD, the monitoring (and management) of the European transboundary river basins is well aligned and harmonized. However, there were considerable differences in the number of parameters and target values used for indicator 6.3.2 reporting. In the case of the Rhine-Meuse river basin, some riparian countries used the WFD data (Austria, the Netherlands), while others (Germany, Switzerland) used data from their annual State of the Environment reporting lines because these data were more up to date and more regularly available (WFD reporting data are only collected every six years). Several European Union Member States have expressed a wish to align their regional (WFD) and global (indicator 6.3.2) reporting more closely to reduce their reporting burden.

For the Limpopo transboundary river basin in Africa, data were submitted by Botswana, South Africa and Zimbabwe. South Africa has very comprehensive water-quality monitoring programmes in place and reported on the complete set of core parameters for rivers and open water bodies using its national water-quality guidelines. Botswana and Zimbabwe used monitoring data for rivers, but with fewer parameters (four) and basin-specific target values.



View from the Iguaçú National Park, an important park of the Prata Basin. Photo: Deni Williams/Creative Commons

3.3. Country focus

Brazil and South Africa are two countries that have established extensive water-quality monitoring programmes. They were asked to provide feedback on their experience implementing the indicator 6.3.2 methodology, which is summarized below.

Brazil

Since 2007, the National Water Agency of Brazil (ANA) has been implementing the National Water Quality Program, which promotes the standardization of monitoring procedures among Brazilian states. In terms of indicator 6.3.2, the absence of E.coli among the core parameters is an issue for Brazil because it is one of the parameters with the highest frequency of non-compliance at the national level. Another consideration when calculating the indicator is that some water bodies have a natural condition (e.g. low pH and dissolved oxygen) that is not compliant with national water-quality standards.

Indicator 6.3.2 takes a different approach to other commonly used water quality indices and as such, additional work was required for the delineation of surface water bodies. In general terms, calculating the 6.3.2 indicator was a good opportunity to compare the results with other indices used in Brazil. The sampling points located in urban areas usually have the lowest values for the National Sanitation Foundation water quality index because of the low sanitation levels and this was also observed in the results for indicator 6.3.2. Given the importance of spatially disaggregated data (e.g. urban or rural areas), this point should be considered in future analyses of indicator 6.3.2.

Another consideration for future versions of the methodology is the increasing number of sampling points in the Brazilian national network. The resulting increase in data availability will have to be considered in the future trend analysis to provide a better assessment of the major river basins in the country. The methodology will need to allow for “back calculation” of future data to account for monitoring programme expansion.

Trend analysis of water quality in Brazil has been a useful mechanism for showing the correlation between investment in sanitation and improved surface water quality. This experience should prove valuable in monitoring indicator 6.3.2 in the country.

South Africa

The South African National Department of Water and Sanitation (DWS) has an existing monitoring network for hydrological data going back about 100 years, and for water-quality data for about half that period. The existence of the network and its associated data systems are established under legislation. The information is primarily used for resource and infrastructure planning, resource operations and management, compliance and auditing, and risk mitigation (2017 review of the national monitoring network is available here).[5]

DWS water-quality staff at the Resource Quality Information Services (RQIS) started participating in the indicator 6.3.2 process in mid-2017, using the *Integrated Monitoring Guide for SDG 6: Step-by step monitoring methodology for indicator 6.3.2 on ambient water quality*. Given the time constraints, the detailed delineation of surface water bodies described in the methodology document was impractical. RQIS therefore used the existing South African drainage regions, which are divided into a four-level hierarchy. The catchments at the tertiary level of this hierarchy were the most practical subdivision, based on the density of the monitoring network. The number of monitoring sites per catchment is uneven: the wetter southern and eastern parts of South Africa have smaller catchments with a higher density of monitoring, while the drier northern and western parts have larger catchments and a lower density of monitoring. All available river and dam (impoundment) data for 2014–2016 were used and measured against a set of arbitrary targets derived from South African guidelines or objectives and suggestions in the Integrated Monitoring Guide. The analysis was formalized in an R script. As requested by UN Environment, RQIS subsequently aggregated data from the tertiary drainage regions to the highest level of the hierarchy, namely, primary drainage regions.

Important simplifications:

- The use of blanket targets, meaning that the baseline may be too strict in some parts and too lax in others.
- The delineation of river water bodies based on tertiary catchments, rather than the procedure illustrated in the Integrated Monitoring Guide.
- The use of all oxygen data for all dams, even those for which only surface measurements were available.
- The omission of oxygen data for rivers since oxygen is only measured in dams.

Some clarification from UN Environment on the following would be helpful: What are the expectations in terms of data and reporting? What is a realistic allocation of staff and time? Is the process meant to show changes across the entirety of each country, or just changes at hotspots? Could the process be more interactive, so that UN Environment staff can advise on decisions such as the important simplifications mentioned above?

[5] http://www.dwa.gov.za/Projects/NWRM/default.aspx

4

Challenges and opportunities

DINEPA agents in Haiti test the quality of water. Photo: UNICEF/Marco Dormino

This section summarizes the challenges faced during the 2017 data drive from the perspective of participating countries. It discusses the elements of indicator 6.3.2 that countries found most challenging to implement and how understanding and addressing these challenges provides opportunities for developing the methodology to facilitate achieving target 6.3 and reaching SDG 6.

4.1. Challenges of 2017 data drive

During the global roll-out of indicator 6.3.2, submissions were received from 52 countries, surpassing the target of 40. The number was not greater owing to several technical factors, which are listed in section 6.2 below. Non-technical factors also played a part – namely, the fact that indicator 6.3.2 was a new indicator; the short reporting time frame; and the Tier 3 status (explained below).

The 2017 data drive was the first time most countries were made aware of the indicator. Communicating the technicalities of the indicator within a short period of time was challenging. Furthermore, many countries did not have the institutional set-up to report national water-quality data. Water quality often falls within the remit of several government ministries, meaning the sector is fragmented. As such, collating the available data proved challenging in the time available. During the data drive, indicator 6.3.2 was categorized as Tier 3 by the Inter-agency Expert Group on SDGs (IAEG-SDGs). 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". This status may have diminished the priority level of indicator 6.3.2 in the face of multiple reporting requests. For future data drives, this may not be an issue because, as a result of the indicator data gathered during the 2017 data drive, 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".

KEY FACTS

Water quality often falls within the remit of several government ministries, meaning the **sector is fragmented**.

The **2017 data drive** was the first time most countries were made aware of the indicator.

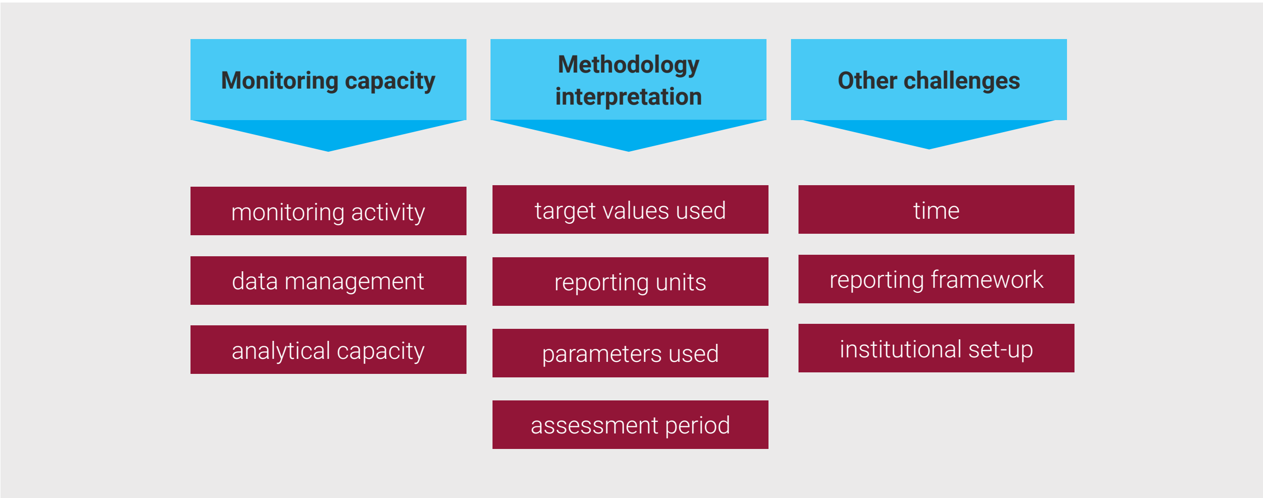
Feedback received from countries highlighted a need for personnel training on water quality across the sector.

Many countries simply **do not maintain sufficient water quality monitoring activities** to report on the indicator.

4.2. Challenging aspects of the methodology

Despite the extensive methodology testing and development phase, challenges regarding several aspects of the methodology did not manifest until the global roll-out and baseline data-collection phase. These have been grouped into three categories and are summarized in Figure 8 below: challenges relating to monitoring capacity; challenges relating to methodology interpretation; and those that cannot be classified as either category.

Figure 8: Summary of challenges faced during the 2017 data drive



4.2.1. Differences in monitoring capacity

Monitoring activities: The indicator 6.3.2 data drive results highlight the differences in resources invested in water-quality monitoring programmes globally. Some of the more developed countries used tens of thousands of monitoring records per year to calculate the indicator with full national coverage, while some of the least developed countries were unable to report the indicator for want of any operational monitoring programmes, or because they only had data available for a single key water body. Figure 9 below highlights this discrepancy, showing the number of monitoring stations against gross domestic product (GDP) per capita for the countries that reported during the 2017 data drive. Many of the lower GDP countries reported using data from very few monitoring stations. Note: there were several high GDP countries that reported using only a selection of their available data.

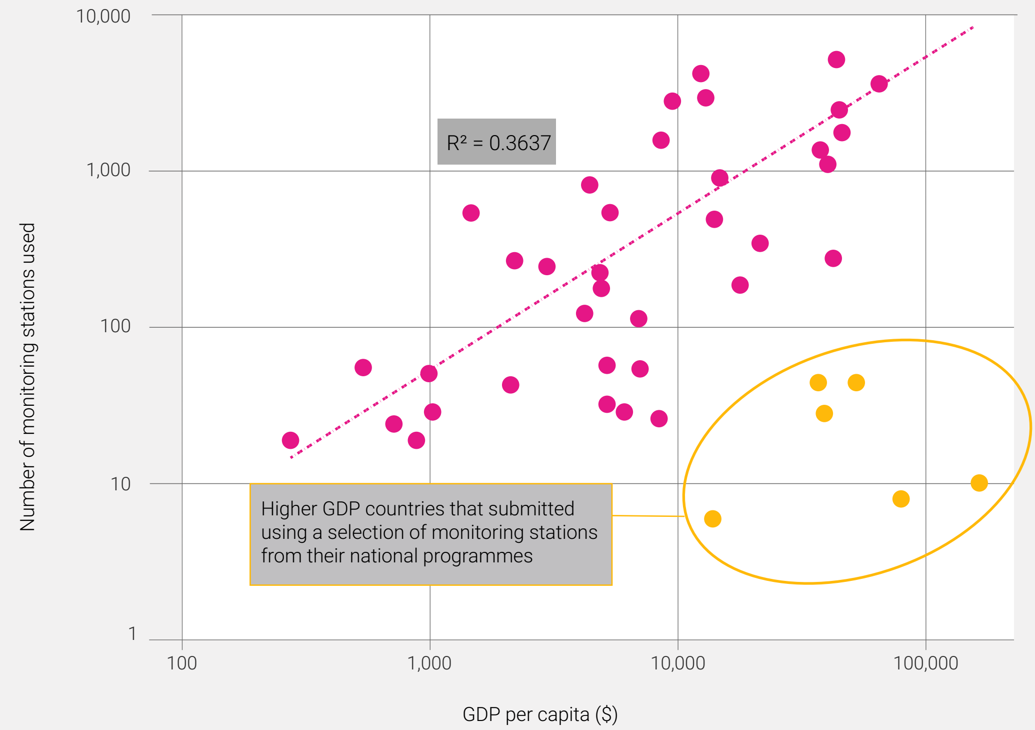
Data collation/management: One of the greatest challenges for countries was the collation of data. Data are often stored regionally or within single institutions and many countries do not have a central database facility for water-quality data. Sometimes data remain in the laboratories where the samples are analysed and are not made available for reporting.

Analytical capacity: The chosen parameters for indicator 6.3.2 reporting are relatively simple to analyse. In situ sensors can be used to measure dissolved oxygen, pH and electrical conductivity, however, these are not available for TON and orthophosphate, which were the suggested forms of nitrogen and phosphorus to measure – for these parameters, a field kit is needed. Irrespective of the level of technical difficulty involved in measuring these parameters, many countries lack the necessary analytical capacity due to a lack of equipment and/or trained analytical staff.

4.2.2. Differences in methodology interpretation

Setting target values: Several countries did not follow the 6.3.2 methodology guidance and employed water-quality standards designed for purposes other than

Figure 9: Number of monitoring stations used in the 2017 data drive against GDP per capita



Source for GDP data: National Accounts Main Aggregates Database, 2016 (Select all countries, "GDP, Per Capita GDP – US Dollars" and "2016" to generate table), United Nations Statistics Division. Accessed 14 May 2018

measuring ambient water quality. Target values used included drinking water, irrigation and effluent standards. It is worth noting that the World Health Organization concentration limit of 50 mg L^{-1} of nitrate in drinking water for human consumption is considered very high for ecosystem health. For comparison, the Irish Environmental Protection Agency uses a guideline value of 7.53 mg L^{-1} NO^{3}.

Delineation of RBDs and water bodies: The methods used to define RBDs and water bodies were not captured in the metadata collected. From the data submissions and feedback received from countries, it appears that various approaches were used, resulting in widely contrasting sizes for these units, and thus diminishing the global comparability of the indicator.

Parameters used: Several countries used a selection of the core parameters, others included additional parameters and some disregarded the core parameters entirely and used those that they felt were most appropriate.

Assessment period: Most countries included monitoring data from between 2010 and 2017. The earliest data included in the data submissions was from 1990. The methodology suggested using data from within the last three years, although it did not specify whether data from all three years, or from a single year, should be used. The preferred strategy would be to use data from across a three-year period to smooth out any anomalous data from any one year.

4.2.3. Other challenges

Time: Evidently, the time allocated to countries to report was insufficient and created resource pressures that could have been avoided had more time been available.

Incompatible reporting framework: Some regions have water-quality assessment systems in place, such as the EU WFD and the African Ministers' Council on Water (AMCOW) Africa Water Sector and Sanitation Monitoring and Reporting online system. Both examples highlight incompatibilities with indicator 6.3.2. Although 17 countries in the European and North American region reported for indicator 6.3.2 – more than in any of the other regions – from the feedback received, it was evident that the indicator 6.3.2 methodology was not followed closely and that European Union countries based their submissions on information gathered for the WFD. Conversely, the AMCOW system goes far beyond the scope of the WFD and encompasses 44 water- and sanitation-related indicators. Efforts have been made to align with the related SDG targets and indicators, but so far, this has not been achieved for indicator 6.3.2. Figure 10 highlights this discrepancy between the equivalent indicators from the two reporting frameworks, and how further harmonizing these could reduce the reporting burden for countries and increase the reliability of the indicators.

Groundwater monitoring: As shown in Figures 4 and 6, groundwaters were reported on by the smallest number of countries. There were also fewer groundwater bodies reported on in total.

Institutional structure and coordination: Many countries do not have the institutional structures and coordination in place to respond to the reporting request and to collate data and mobilize the necessary personnel.

4.3. Potential solutions

Several potential solutions to the major challenges identified while developing the methodology and during the 2017 data drive are outlined below.

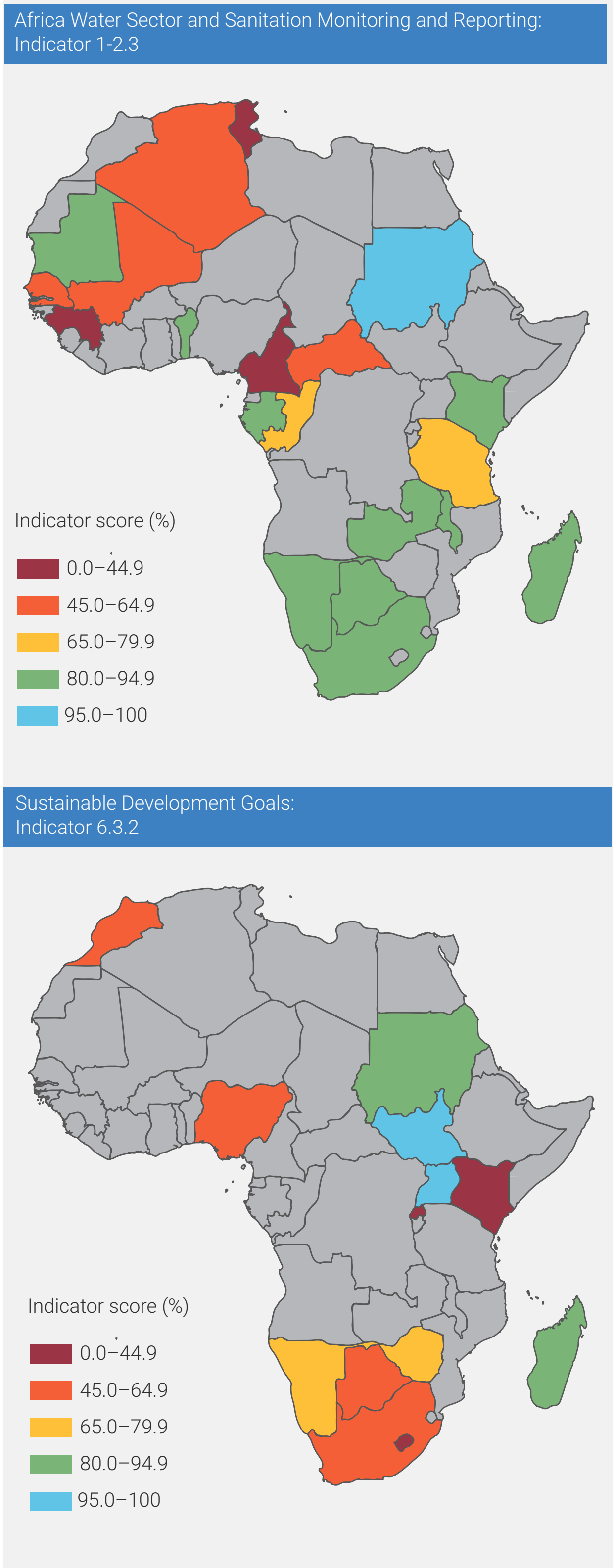
4.3.1. Monitoring capacity

An assessment process to gain an understanding of the current monitoring capacity is a critical first step, as highlighted in the indicator 6.3.2 methodology. Water-quality monitoring is often undertaken across a wide range of ministries and organizations. As such, monitoring capacity or the existence of water-quality data that could contribute towards indicator 6.3.2 reporting may be dispersed and overlooked.

The Framework for Freshwater Ecosystem Management (UNEP, 2017) stipulates that a "capacity assessment phase" should focus on four components:

- **Enabling environment:** The existence of provisions in government plans, policies and law related to the protection and sustainable use of freshwater ecosystems.
- **Institutions and participation:** The institutional and human capacity, from the national level through subnational and basin levels to the local level, to manage and protect freshwater ecosystems. The capacity to effectively engage with the private sector and

Figure 10: Comparison of SDG indicator 6.3.2 reporting for 2017 with AMCOW's indicator I-2.3 (Proportion of bodies of water with good ambient water quality)



Source: AMCOW, 2016

other stakeholder groups should also be assessed.

- **Management instruments:** Monitoring programmes, and financial incentives and measures to protect and restore ecosystems.
- **Financing:** Financial resources available, including grants and more sustainable revenue streams.

Ministries or authorities with an environmental or water resource protection remit are often mandated to monitor and protect ambient water quality, but in reality, the resources allocated are often insufficient to support an operational monitoring programme. Water-quality monitoring programmes are often well financed during crises. However, the routine, long-term monitoring that is needed to build a picture of trends in water quality at the national level, and also needed for indicator 6.3.2 reporting, is generally underfunded. During its third session, the UN Environment Assembly adopted a comprehensive resolution (UNEP/EA.3/Res. 10) "addressing water pollution to protect and restore water-related ecosystems", sending a clear message and a strong mandate to UN Environment and UN-Water partners to support monitoring and raise awareness of the need to strengthen water-quality governance at the national and transboundary level.

Reflecting the scale of the entire hydrological cycle expressed in SDG 6, the resolution "emphasizes the need for Member States, in collaboration with UNEP and other UN agencies, to **address water pollution in inland, coastal and marine ecosystems and improve water quality** by, inter alia, increasing efforts in pollution prevention at all levels, water governance at the national level, integrated water resources management, sustainable use of water, as appropriate, and **improved water-quality data collection, and improved data sharing on a voluntary basis**, which should support implementation of the water-related Sustainable Development Goals (SDGs) and their interrelated targets…".

The comprehensive mandate embedded in the resolution underlines that monitoring programmes should comprise essential components that are necessary for the Integrated Monitoring Initiative, in its entirety, to fulfil its objectives, and for the ambient water-quality efforts, in particular, to be successful. The indicator 6.3.2 monitoring programme must be designed, samples must be collected and analysed, and the data must be well managed and stored, assessed and then made available for reporting. Each component must be undertaken and performed by trained water-quality personnel, taking into consideration quality assurance and quality control protocols. Feedback received from countries highlighted a need for personnel training on water quality across the sector, as well as a critical need for data management expertise and infrastructure. The UN Environment GEMS/Water programme has started to address this through its Capacity Development Centre and Data Centre.

4.3.2. Methodology interpretation

Differences in the interpretation of the methodology can be partly resolved by describing the various implementation steps in more detail in future versions. This is being addressed with the release of the indicator 6.3.2 Expanded Methodology, which will be made available before the next data drive. This supporting document will include technical guidance and details of each step of the methodology.

The short reporting period for the 2017 data drive minimized the time available for countries to engage with UN Environment. As previously mentioned, a number of resources were made available and a help desk was set up to enable countries to seek clarification. However, it was clear from the questionnaire responses that use of these resources was limited, with some countries submitting their reports without reference to the written methodology.

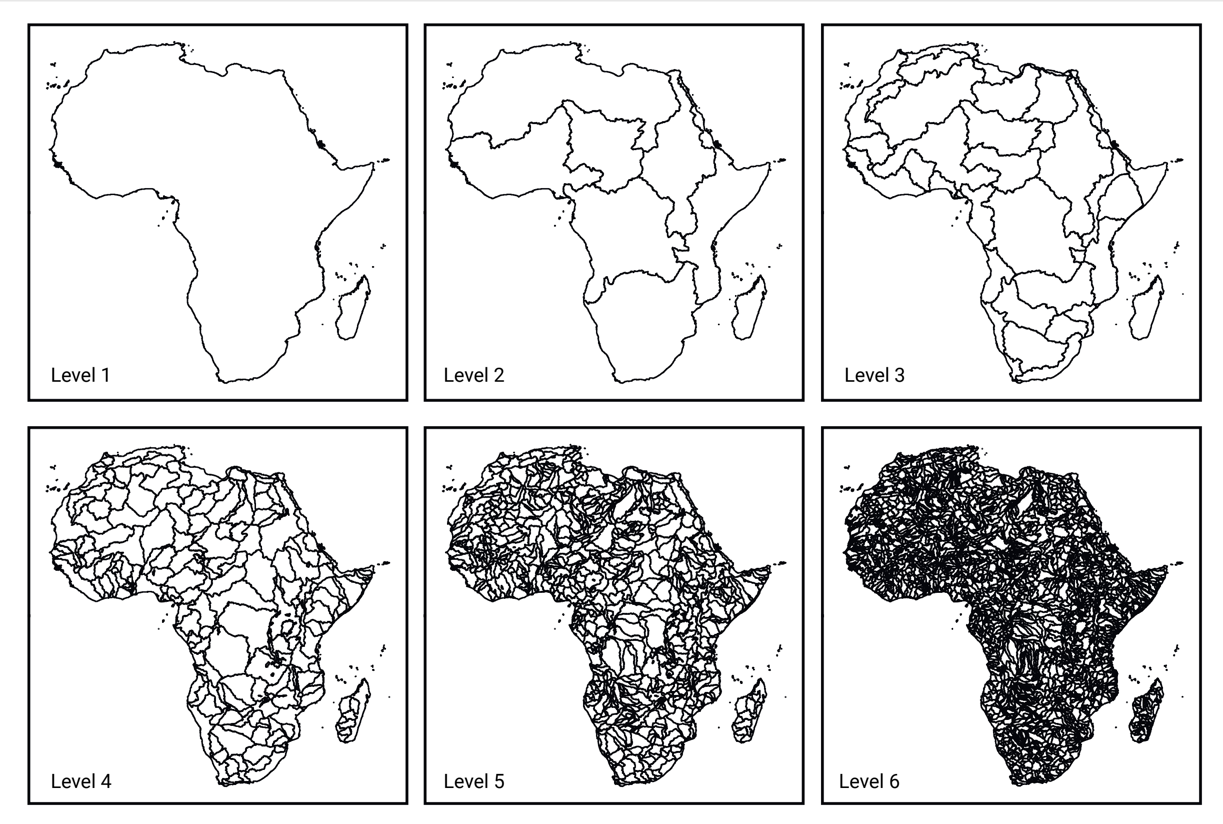
The specific technical aspects of the methodology that countries interpreted differently and the possible reasons for this are discussed below.

Setting target values: 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. It is therefore advised that each country determines its own definition of "good ambient water quality" and sets its own targets for assessing water quality. In this respect, the standards or 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-setting proved a challenge for many countries. An absolute measure of water quality, reached by comparing measured values against target values, 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. An alternative method would be to compare water-quality data for a given reporting period with water-quality data from the previous reporting period. This would result in an "improving", "stable" or "degrading" measure of water quality over time. To provide an indication of the status of water bodies, this would need to be combined with the current absolute method of assessment; however, for many countries, this is beyond their current capacity.

Delineation of RBDs and water bodies: Further guidance is needed to help countries delineate RBDs and water bodies. A web-based system enabling countries to select and download both types of hydrological unit would increase global comparability and reduce the reporting burden on countries. Global data sets exist that could potentially provide this information. One such example is the HydroBASINS database (Lehner and Grill, 2013), however, this data set has a number of limitations. Above 60°N and below 56°S latitudes, the resolution of the underlying surface model used to generate the river basins is coarser than between these two latitudes (1 km rather than 90 m resolution). The river basins are also available at a range of spatial scales, starting from the largest at Level 1, to the smallest at Level 12 (Figure 11 and Figure 12 below), but it is unlikely that one scale would be appropriate for all Member States due to the vastly different areas covered by individual countries. Trials in mid-latitude countries found that using the HydroBASINS data at between Levels 6 and 8 produced usable results; these could then serve as a starting point for countries to validate and customize their own water bodies and RBDs. Countries using an existing system for water body and river basin delineation, such as the EU WFD countries, will encounter harmonization difficulties. The HydroBASINS data set is currently used by the International Union for Conservation of Nature to map freshwater species globally (IUCN, 2017), and also as the basis for the UN Environment Global Environment Facility Transboundary Waters Assessment Programme (UNEP-GEF TWAP) data portal[6] (UNEP-DHI and UNEP, 2016). The HydroLAKES data set (Messager *et al.*, 2016) of over 1.4 million lakes could also serve as a starting point for countries lacking hydrological data on lake water bodies.

Parameters used: Specifying that countries can use a selection of parameters from parameter groups, rather than prescribing core parameters, will increase

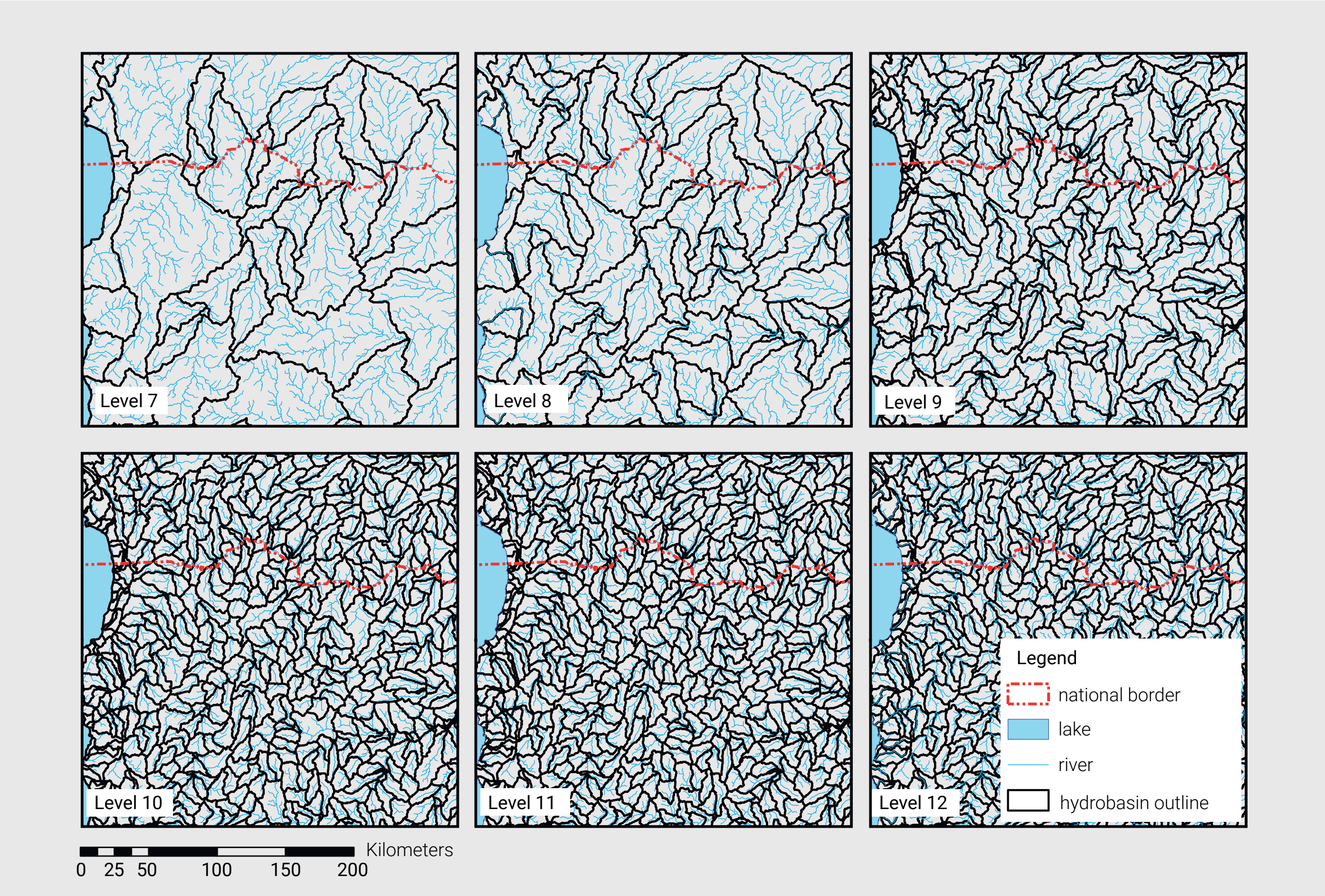
Figure 11: Example of HydroBASINS data for Africa, Levels 1 to 6



Source: Lehner, B. HydroBASINS Global watershed boundaries and sub-basin delineations from HydroSHEDS data at 15 second resolution Technical Documentation Version 1.c (with and without inserted lakes). Available at: http://www.hydrosheds.org/images/inpages/HydroBASINS_TechDoc_v1c.pdf

[6] http://twap-rivers.org/indicators/

Figure 12: Example of HydroBASINS data for Africa, Levels 7 to 12



Source: Lehner, B. HydroBASINS Global watershed boundaries and sub-basin delineations from HydroSHEDS data at 15 second resolution Technical Documentation Version 1.c (with and without inserted lakes). Available at: http://www.hydrosheds.org/images/inpages/HydroBASINS_TechDoc_v1c.pdf

Table 4: List of potential parameter groups and core parameters for the various water body types

Parameter group	Parameter	River	Lake	Groundwater
Oxygen	Dissolved oxygen	x	x	
	Biological oxygen demand, chemical oxygen demand	x		
Salinity	Electrical conductivity *Salinity, total dissolved solids*	x	x	x
Nitrogen*	Total oxidized nitrogen *Total nitrogen, nitrite, ammoniacal nitrogen*	x	x	
	Nitrate**			x
Phosphorus*	Orthophosphate *Total phosphorous*	x	x	
Acidification	pH	x	x	x

**Countries should include the fractions of nitrogen and phosphorus that are most relevant nationally*
***Nitrate is suggested for groundwater due to associated human health risks*

Sha Tin Sewage Treatment Project in Hong Kong, China. Photo: Asian Development Bank

compliance with the recommended methodology. It will also facilitate the use of existing water-quality data, to avoid having to adapt monitoring programmes to be compliant. Table 4 above shows the recommended core parameters as well as alternative core parameters (italic) that can be used, depending on data availability and applicability for the specific water body types.

Assessment period: The temporal inconsistency in data used by countries in their submissions was partially related to a lack of availability of more recent data. A revamp of monitoring activities in countries with limited access to water-quality data, and a boost in countries whose monitoring activities have declined in recent decades, along with a greater awareness of the need for data for indicator 6.3.2, could counter this problem, making a greater volume of data available for indicator 6.3.2 reporting in the future.

4.3.3. Other challenges

Time: The next data drive is provisionally scheduled for 2021, which will provide a greater lead-in time for preparation and engagement with Member States. This should alleviate the pressures associated with the short time frame imposed during the 2017 data drive.

Incompatible reporting framework: Efforts are already under way to align with the European WFD and African AMCOW reporting frameworks. Overcoming this compatibility issue will require greater flexibility of indicator 6.3.2, and the reporting structure to be streamlined. If successful, and endorsed by the respective Member States, it will reduce the reporting burden on countries that are currently being asked to report twice for essentially the same purpose.

Groundwater monitoring: 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.

Institutional structure and coordination: The SDGs provide a foundation for strengthening institutional structures and coordination, which is reinforced by the recent resolution on water quality and pollution (UNEP/EA.3/Res. 10). Guidance to achieve this is provided in the Framework for Freshwater Ecosystem Management launched at the Third Session of the UN Environment Assembly (UNEA 3) in 2018 (UNEP, 2017).

5

Future of methodology

Water pours into a rice field in Sapa, Viet Nam. UN Photo/Kibae Park

Aligning the indicator 6.3.2 methodology, the upcoming UN Environment World Water Quality Assessment (WWQA) (UN-Water, 2016) – requested during UNEA 3 and explicitly in resolution UNEP/EA.3/Res. 10 – and the published Framework for Freshwater Ecosystem Management (UNEP, 2017) will render each component more useful and will provide a coherent framework for countries to adopt. SDG monitoring will improve data availability to support the WWQA; simultaneously, the Framework for Freshwater Ecosystem Management will provide a framework to combine these monitoring and assessment aspects for the protection of ecosystems, thereby linking with indicator 6.6.1. This will provide more information on the factors and pressures influencing water quality, as well as their impacts and the corresponding responses, rather than just on the perceived status quo.

The feedback received highlighted that more support is needed to ensure clarity on the complexities and details of the indicator methodology. Going forward, countries that have sufficient data to report, but that may find it difficult to convert their data into an indicator score should receive more support at every stage of the process – this should start from the initial reporting request and extend through to indicator submission. Some countries will require a number of "services", including assistance with: determining hydrological reporting units and water bodies; selecting monitoring stations; selecting appropriate target values; and calculating the indicator from water-quality data and associated metadata.

For countries that are unable to report on indicator 6.3.2, extensive capacity development is needed to put these countries in a position to do so. Mobile monitoring methods, such as using sensors and field kits, can be adopted in the short term until there is sufficient laboratory-based analytical capacity.

Future versions of the indicator 6.3.2 methodology will need to allow greater flexibility to align with existing reporting frameworks and to leverage existing monitoring data sources. Few of the European Union countries followed the indicator methodology and instead chose to report using data submitted for the EU WFD. To ensure global comparability, and to avoid burdening countries with additional reporting requirements, the 6.3.2 methodology should offer the flexibility to directly incorporate information submitted to the European Environment Agency and extract it for SDG reporting purposes. In-country engagement should ideally rely on the same national reference centres/contacts when it comes to water quality-related data and analysis. This alignment is one of the key aspects to be strengthened in practice across various elements of the SDG 6 monitoring and reporting process.

The indicator methodology needs to be "future proofed" to ensure that efforts to expand monitoring networks and develop analytical methods do not diminish the temporal comparability of the indicator over time. This can be achieved by encouraging countries to store the correct metadata, along with water-quality data, to allow future assessments to "back cast" and deduce a previous reporting period's data using the most current method.

From the feedback received, there was strong support for the concept of an "improving versus degrading" method of water-quality assessment. This method would compare the water quality of a given assessment period with that of a previous one. For example, if average nutrient concentrations in a lake had dropped, this would be interpreted as an improvement. This assessment method aligns with the current national approach in several countries and eliminates the need to set numerical target values – an aspect identified as one of the more challenging of the methodology and one that diminishes the global comparability of the indicator.

"Going forward, countries that have sufficient data to report, but that may find it difficult to convert their data into an indicator score should receive more support at every stage of the process – this should start from the initial reporting request and extend through to indicator submission. "

Under the target-based method, if neighbouring countries choose to set different targets for the same transboundary water body, their assessments of the same water body may contradict each other.

There is a challenge in incorporating additional data sources such as biological approaches, Earth observation data, citizen science projects and private sector data into the reporting methodology. These sources, and the best methods of incorporating them, are currently being investigated.

For the 2017 baseline period, countries were requested to report the core five parameters for surface waters and three for groundwaters, and not to include progressive monitoring steps. In future data drives, the inclusion of progressive data sets will broaden the reach and impact of indicator 6.3.2 and will raise the profile of ambient water-quality monitoring. It will also better serve national interests in monitoring and assessment, and ultimately, in protection of water resources.

A common reporting unit, such as river basins, for all SDG 6 indicators would help link SDG 6 indicators that measure impacts on, and benefits to, water quality and its management. In addition to national reporting, a common reporting unit at the subnational level would enable spatial variation across a country to be illustrated – for example, the lack of wastewater treatment could be mapped directly onto ambient water quality (indicator 6.3.1). It would help identify where the implementation of integrated water resources management (indicator 6.5.1), which is unlikely to be standardized across the country, corresponds to poor ambient water quality. The common reporting unit would also link access to safe drinking water (indicator 6.1.1) to ambient water quality and enable the mapping of areas that are prone to water stress (indicator 6.4.2), a factor which can be compounded by poor ambient water quality.

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Annex 1 Full results table

Country	Assessment period	Percentage of water bodies with good water quality				Number of assessed water bodies	Number of monitoring locations	Number of monitoring values
		Open water	River	Groundwater	Total			
Andorra	2016	0	100	75	92.86	14	44	471
United Arab Emirates	2005–2016	0	0	66.67	66.67	3	1,400	1,840
Austria	2013–2015	91.94	80.12	94.57	80.44	8,256	2,496	18,641
Brazil	2015	74.63	73.04	0	73.32	386	1,594	5,550
Botswana	2011–2016	94.44	94.74	7.69	50	76	114	46
Switzerland	2015	0	100	0	100	4	8	568
Chile	2014–2017	50	50	100	66.67	6	6	59
Germany	2014	72.41	35.08	0	38.99	277	277	4,448
Estonia	2010–2013	100	100	0	100	102	189	6,838
Finland	2006–2012	80.82	64.09	76.35	76.06	10,084	5,229	93,382
Fiji	2014–2016	100	100	100	100	77	58	2,349
Hungary	2009–2012	41.77	53.6	81.98	57.66	973	2,953	134,801
Ireland	2010–2015	45.78	56.72	91.42	61.69	3,083	3,678	10,707
Jamaica	2014–2016	0	92.08	0	92.08	101	177	1,481
Japan	2012–2015	75	30	0	37.5	16	28	3,009
Kenya	2011–2016	0	30.52	42.18	35.5	307	551	21,608
Korea (Republic of)	2015–2016	0	82.61	96.01	87.29	716	0	0
Lebanon	1990–2017	0	50	100	50	6	26	672
Liechtenstein	2016–2017	0	77.78	100	80	10	10	480
Lesotho	2016–2017	0	33.33	0	16.67	6	29	19
Lithuania	2010–2013	74.69	41.12	100	55.39	659	907	6,912
Latvia	2010–2016	52.9	72.44	100	64.41	281	501	11,550
Morocco	2016–2017	85.94	76.14	76.27	79.15	211	244	17
Montenegro	2016	100	100	0	94.12	17	53	1,050
Madagascar	2015–2017	94.59	94.12	81.58	90.91	143	0	0
Marshall Islands	2016–2017	100	0	100	100	2	9	3
Macedonia (the former Yugoslav Republic of)	2010–2016	0	12.5	0	8.7	23	32	0
Namibia	2008–2016	60	85.71	100	78.57	14	820	0
Nigeria	2014	41	66.27	0	52.46	183	265	0
Netherlands	2009–2014	53.22	47.15	86.96	52.22	720	1,790	1,662
New Zealand	2009–2013	87.64	99.58	0	97.7	1,130	1,130	59,515
Peru	2014–2016	0	36.84	0	36.84	19	29	397
Poland	2010–2012	38.51	30.64	85.71	33.71	5,805	4,213	0
Romania	2016	62.61	57.37	83.69	61.37	1,077	2,609	56,964
Rwanda	2016–2017	0	37.5	0	30	10	24	2
Sudan	2016–2017	70	100	90	86.05	43	43	221
Sweden	2010–2015	48.85	31.77	97.7	45.13	25,825	0	0
Slovenia	2014–2016	9.09	80.43	90.48	75.81	124	350	2,540
El Salvador	2006–2013	0	43.33	0	43.33	60	124	7,320
Tanzania (United Republic of)	2014–2016	0	0	0	0	1	19	299
South Africa	2014–2016	62.5	37.05	0	46.92	454	551	78,304
Zimbabwe	2014–2017	0	76.47	0	76.47	34	51	540

Country	Assessment period	Percentage of water bodies with good water quality				Number of assessed water bodies	Number of monitoring locations	Number of monitoring values
		Open water	River	Groundwater	Total			
Guatemala	-	0	0	0	0	0	0	0
Bosnia and Herzegovina	2009–2016	100	4.89	16.67	5.79	1,624	224	62,855
Burundi	2014–2017	0	0	0	0	52	19	14,566
Benin	1999–2002	0	0	0	0	64	0	0
Jordan	2015–2016	90	66.67	100	92	25	124	0
Singapore	2015–2016	100	0	0	100	17	44	13,274
Sierra Leone	2012–2016	0	0	0	0	14	0	0
South Sudan	2010–2012	100	100	100	100	105	55	55
Tunisia	2010–2015	0	0	0	0	2,613	0	0
Uganda	2012–2015	100	100	0	100	8	8	8

Boxes, figures and tables

LEARN MORE ABOUT PROGRESS TOWARDS SDG 6

6 CLEAN WATER AND SANITATION

SDG 6 expands the MDG focus on drinking water and basic sanitation to include the more holistic management of water, wastewater and ecosystem resources, acknowledging the importance of an enabling environment. Bringing these aspects together is an initial step towards addressing sector fragmentation and enabling coherent and sustainable management. It is also a major step towards a sustainable water future.

The monitoring of progress towards SDG 6 is a means to making this happen. High-quality data help policy- and decision makers at all levels of government to identify challenges and opportunities, to set priorities for more effective and efficient implementation, to communicate progress and ensure accountability, and to generate political, public and private sector support for further investment.

In 2016–2018, following the adoption of the global indicator framework, the UN-Water Integrated Monitoring Initiative focused on establishing the global baseline for all SDG 6 global indicators, which is essential for effective follow-up and review of progress towards SDG 6. Below is an overview of the resultant indicator reports produced in 2017–2018. UN-Water has also produced the SDG 6 Synthesis Report 2018 on Water and Sanitation, which, building on baseline data, addresses the cross-cutting nature of water and sanitation and the many interlinkages within SDG 6 and across the 2030 Agenda, and discusses ways to accelerate progress towards SDG 6.

Progress on Drinking Water, Sanitation and Hygiene – 2017 Update and SDG Baselines (including data on SDG indicators 6.1.1 and 6.2.1) By WHO and UNICEF	One of the most important uses of water is for drinking and hygiene purposes. A safely managed sanitation chain is essential to protecting the health of individuals and communities and the environment. By monitoring use of drinking water and sanitation services, policy- and decision makers can find out who has access to safe water and a toilet with handwashing facilities at home, and who requires it. Learn more about the baseline situation for SDG indicators 6.1.1 and 6.2.1 here: http://www.unwater.org/publication_categories/whounicef-joint-monitoring-programme-for-water-supply-sanitation-hygiene-jmp/.
Progress on Safe Treatment and Use of Wastewater – Piloting the monitoring methodology and initial findings for SDG indicator 6.3.1 By WHO and UN-Habitat on behalf of UN-Water	Leaking latrines and raw wastewater can spread disease and provide a breeding ground for mosquitoes, as well as pollute groundwater and surface water. Learn more about wastewater monitoring and initial status findings here: http://www.unwater.org/publications/progress-on-wastewater-treatment-631.
Progress on Ambient Water Quality – Piloting the monitoring methodology and initial findings for SDG indicator 6.3.2 By UN Environment on behalf of UN-Water	Good ambient water quality ensures the continued availability of important freshwater ecosystem services and does not negatively affect human health. Untreated wastewater from domestic sources, industry and agriculture can be detrimental to ambient water quality. Regular monitoring of freshwaters allows for the timely response to potential sources of pollution and enables stricter enforcement of laws and discharge permits. Learn more about water quality monitoring and initial status findings here: http://www.unwater.org/publications/progress-on-ambient-water-quality-632.
Progress on Water-Use Efficiency – Global baseline for SDG indicator 6.4.1 By FAO on behalf of UN-Water	Freshwater is used by all sectors of society, with agriculture being the biggest user overall. The global indicator on water-use efficiency tracks to what extent a country's economic growth is dependent on the use of water resources, and enables policy- and decision makers to target interventions at sectors with high water use and low levels of improved efficiency over time. Learn more about the baseline situation for SDG indicator 6.4.1 here: http://www.unwater.org/publications/progress-on-water-use-efficiency-641.

Progress on Level of Water Stress – Global baseline for SDG indicator 6.4.2 By FAO on behalf of UN-Water	A high level of water stress can have negative effects on economic development, increasing competition and potential conflict among users. This calls for effective supply and demand management policies. Securing environmental water requirements is essential to maintaining ecosystem health and resilience. Learn more about the baseline situation for SDG indicator 6.4.2 here: http://www.unwater.org/publications/progress-on-level-of-water-stress-642.
Progress on Integrated Water Resources Management – Global baseline for SDG indicator 6.5.1 By UN Environment on behalf of UN-Water	Integrated water resources management (IWRM) is about balancing the water requirements of society, the economy and the environment. The monitoring of 6.5.1 calls for a participatory approach in which representatives from different sectors and regions are brought together to discuss and validate the questionnaire responses, paving the way for coordination and collaboration beyond monitoring. Learn more about the baseline situation for SDG indicator 6.5.1 here: http://www.unwater.org/publications/progress-on-integrated-water-resources-management-651.
Progress on Transboundary Water Cooperation – Global baseline for SDG indicator 6.5.2 By UNECE and UNESCO on behalf of UN-Water	Most of the world's water resources are shared between countries; where the development and management of water resources has an impact across transboundary basins, cooperation is required. Specific agreements or other arrangements between co-riparian countries are a precondition to ensuring sustainable cooperation. SDG indicator 6.5.2 measures cooperation on both transboundary river and lake basins, and transboundary aquifers. Learn more about the baseline situation for SDG indicator 6.5.2 here: http://www.unwater.org/publications/progress-on-transboundary-water-cooperation-652.
Progress on Water-related Ecosystems – Piloting the monitoring methodology and initial findings for SDG indicator 6.6.1 By UN Environment on behalf of UN-Water	Ecosystems replenish and purify water resources and need to be protected to safeguard human and environmental resilience. Ecosystem monitoring, including that of ecosystem health, highlights the need to protect and conserve ecosystems and enables policy- and decision makers to set de facto management objectives. Learn more about ecosystem monitoring and initial status findings here: http://www.unwater.org/publications/progress-on-water-related-ecosystems-661.
UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2017 report – Financing universal water, sanitation and hygiene under the Sustainable Development Goals (including data on SDG indicators 6.a.1 and 6.b.1) By WHO on behalf of UN-Water	Human and financial resources are needed to implement SDG 6, and international cooperation is essential to making it happen. Defining the procedures for local communities to participate in water and sanitation planning, policy, law and management is vital to ensuring that the needs of everyone in the community are met, and to ensuring the long-term sustainability of water and sanitation solutions. Learn more about the monitoring of international cooperation and stakeholder participation here: http://www.unwater.org/publication_categories/glaas/.
SDG 6 Synthesis Report 2018 on Water and Sanitation By UN-Water	This first synthesis report on SDG 6 seeks to inform discussions among Member States during the High-level Political Forum on Sustainable Development in July 2018. It is an in-depth review and includes data on the global baseline status of SDG 6, the current situation and trends at the global and regional levels, and what more needs to be done to achieve this goal by 2030. Read the report here: http://www.unwater.org/publication_categories/sdg-6-synthesis-report-2018-on-water-and-sanitation/.

UN-WATER REPORTS

UN WATER

UN-Water coordinates the efforts of United Nations entities and international organizations working on water and sanitation issues. By doing so, UN-Water seeks to increase the effectiveness of the support provided to Member States in their efforts towards achieving international agreements on water and sanitation. UN-Water publications draw on the experience and expertise of UN-Water's Members and Partners.

PERIODIC REPORTS

Sustainable Development Goal 6 Synthesis Report 2018 on Water and Sanitation

The SDG 6 Synthesis Report 2018 on Water and Sanitation was published in June 2018 ahead of the High-level Political Forum on Sustainable Development, where Member States reviewed SDG 6 in depth. Representing a joint position from the United Nations family, the report offers guidance to understanding global progress on SDG 6 and its interdependencies with other goals and targets. It also provides insight into how countries can plan and act to ensure that no one is left behind when implementing the 2030 Agenda for Sustainable Development.

Sustainable Development Goal 6 Indicator Reports

This series of reports shows the progress towards targets set out in SDG 6 using the SDG global indicators. The reports are based on country data, compiled and verified by the United Nations organizations serving as custodians of each indicator. The reports show progress on drinking water, sanitation and hygiene (WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene for targets 6.1 and 6.2), wastewater treatment and ambient water quality (UN Environment, UN-Habitat and WHO for target 6.3), water-use efficiency and level of water stress (FAO for target 6.4), integrated water resources management and transboundary water cooperation (UN Environment, UNECE and UNESCO for target 6.5), ecosystems (UN Environment for target 6.6) and means for implementing SDG 6 (UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water for targets 6.a and 6.b).

World Water Development Report

This annual report, published by UNESCO on behalf of UN-Water, represents the coherent and integrated response of the United Nations system to freshwater-related issues and emerging challenges. The theme of the report is harmonized with the theme of World Water Day (22 March) and changes annually.

Policy and Analytical Briefs

UN-Water's Policy Briefs provide short and informative policy guidance on the most pressing freshwater-related issues, which draw upon the combined expertise of the United Nations system. Analytical Briefs provide an analysis of emerging issues and may serve as a basis for further research, discussion and future policy guidance.

UN-WATER PLANNED PUBLICATIONS 2018

- Update of UN-Water Policy Brief on Water and Climate Change
- UN-Water Policy Brief on the Water Conventions
- UN-Water Analytical Brief on Water Efficiency

More information on UN-Water Reports at www.unwater.org/publications

Good ambient water quality ensures the continued availability of important freshwater ecosystem services and does not negatively affect human health. Untreated wastewater from domestic sources, industry and agriculture can be detrimental to ambient water quality. Regular monitoring of freshwaters allows for the timely response to potential sources of pollution and enables stricter enforcement of laws and discharge permits. In this report, you can learn more about water quality monitoring and initial status findings.

This report is part of a series that track progress towards the various targets set out in SDG 6 using the SDG global indicators. To learn more about water and sanitation in the 2030 Agenda for Sustainable Development, and the Integrated Monitoring Initiative for SDG 6, visit our website: www.sdg6monitoring.org

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