SDG Indicator 6.3.2 Technical Guidance Document No. 6: Citizen Science

This document provides practical guidelines for national authorities seeking to strengthen water quality monitoring through citizen-generated data. This guideline supports national authorities in integrating citizen-generated water quality data into their national monitoring programmes for SDG Indicator 6.3.2: Proportion of bodies of water with good ambient water quality.

It provides:

- a clear explanation of how citizen science can contribute to SDG Indicator 6.3.2;
- information on preconditions that must be met for citizen-generated data to be usable;
- four development pathways for different national contexts;
- practical guidance on designing and implementing an integrated monitoring programme (national authority plus citizen data); and,
- steps for including citizen-generated data in official SDG Indicator 6.3.2 submissions.

This document complements the Introduction to SDG Indicator 6.3.2[1] and the Technical Document Level 2 Monitoring[2], available on the SDG Water Quality Hub[3] and draws on the experience of several projects of the World Water Quality Alliance Citizen Science for SDG 632 workstream[4] and their Technical Brief - The role of citizen science in improving ambient water quality[5].

Many countries lack sufficient water quality data to assess the condition of their freshwater resources or report reliably on SDG Indicator 6.3.2. Citizen science offers a practical way to expand monitoring coverage, strengthen national datasets, and engage communities in water resource management. When volunteers are trained, supported, and integrated into existing systems, their observations can complement official monitoring and contribute directly to SDG reporting. This guideline provides national authorities with clear, practical steps for incorporating citizen-generated data into their monitoring programmes, outlining the conditions needed for success, the development pathways available for different national contexts, and the key actions required to design, implement, and assess an integrated approach to water quality monitoring.

Background and Context

SDG Indicator 6.3.2 has revealed the stark reality that many countries lack sufficient water quality data. This data gap is especially pronounced in low- and middle-income countries, where national monitoring networks are often under-resourced.

In real terms, this means that those national authorities that are tasked with managing their country's freshwaters are unable to answer very basic questions on current status and trends, and that the multiple pressures that water bodies are facing,

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[1] https://wwqa.info/wp-content/uploads/2025/08/SDG632_Introduction-to-the-Methodology_20230420.pdf
[2] https://wwqa.info/wp-content/uploads/2025/08/SDG632_Level2_Reporting_20230418.pdf
[3] https://sdg632hub.org/
[4] https://wwqa.info/workstreams/citizen-science/
[5] https://zenodo.org/records/12634359

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and the impacts these pressures are having are going unchecked. The future ability of these freshwaters to provide the services that are essential for sustainable development go largely unknown, because without adequate data, national authorities struggle to: identify pollution pressures; track changes in water quality; prioritise management actions; or, protect ecosystems and human health.

SDG Indicator 6.3.2 allows Member States to track progress towards Target 6.3: improving water quality. The indicator is divided into Level 1 and Level 2 reporting. Level 1 is the required component of the indicator framework that ensures the global comparability of the indicator by prescribing measurement of standardised basic core parameters that are relevant globally. The parameters included are: nutrients (nitrogen and phosphorus); oxygen; salinity and pH. Level 2 reporting is less constrained and provides the flexibility to report using other water quality parameters or approaches to monitoring such as biological or satellite-based Earth Observation.

Citizen-generated data can be used to report on this indicator at either Level 1 or 2. For Level 1 reporting the data must be constrained to *in situ* measurements, and cover one or more of the five core parameters. Other approaches to monitoring such as using biological approaches or alternative parameters such as metals can also be included in this framework, but these data types would be considered as part of a Level 2 submission (Figure 1).

During the 2023 data drive for SDG Indicator 6.3.2, two country submissions combined citizen-generated data with national authority data (Sierra Leone and Zambia). These efforts were supported by the UNEP-convened World Water Quality Alliance (WWQA) *Workstream on Citizen Science for SDG Indicator 632*. As part of this initiative, several other countries are collecting citizen-generated water quality with a view to integrating them with national data for SDG Indicator 6.3.2 reporting. This document draws upon the experiences of those countries, from which three preconditions that must be met are defined, and different pathways are laid based on different national contexts.

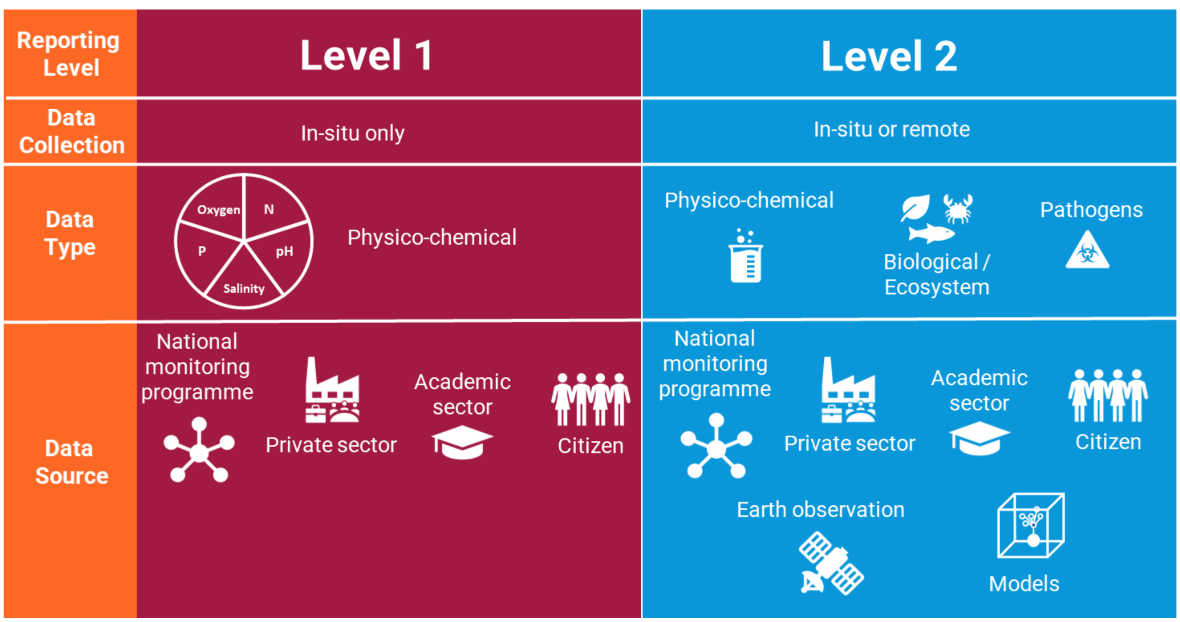

Figure 1: Schematic of similarities and differences between mandatory Level 1 and optional Level 2 reporting in terms of data collection, data type and data source that can be used.

Overview of Citizen Science and Water Quality Monitoring

Citizen science refers to the participation of non-professional scientists in data collection, analysis, or interpretation. It has a long history in environmental monitoring and is increasingly recognised as a valuable source of data for the SDGs. Citizen science can support all types of water quality monitoring programmes, but it is particularly well suited to long-term, broad-scale monitoring, which aligns closely with SDG Indicator 6.3.2.

The key benefits of this approach are many, but when compared to 'traditional' monitoring programmes operated by national authorities which are responsible for water resource monitoring, the main benefits can be summarised as:

- Improved data:
    - increased spatial data coverage from locations that are difficult or costly to collect data from; and,
    - higher temporal resolution with the potential to collect at monthly rather than quarterly frequencies.
- Enhanced engagement:
    - incorporating and engaging local knowledge;
    - increasing support for decision making processes;
    - building trust between communities and national authorities;
    - co-creating solutions to water quality issues; and,
    - promoting inclusion and more just access to science.
- Cost-effectiveness:
    - lower cost per measurement compared to traditional monitoring; and,
    - efficient use of limited national resources.

While citizen science can greatly expand monitoring coverage, it also has limitations, including variability in methods, differences in participant skill levels, and the need for strong quality assurance to ensure that data are reliable and comparable with national authority datasets

Preconditions for Using Citizen Science in SDG 6.3.2 Reporting

To ensure citizen-generated data can be used reliably, three preconditions must be met:

1. data meets the requirements of the indicator;
2. citizen science participants are willing and able to collect the data; and,
3. there is an enabling conditions that allows both the participants and the data they produce to be incorporated into national water resource management.

Authorities can use citizen-generated data received from external projects, run their own initiatives, or combine both approaches. Regardless of the model adopted, meeting the three required preconditions depends on strong cooperation among all stakeholders. The checklist (Figure 2) can be used to help assess whether a citizen science project can support water monitoring and management, highlighting key considerations for national authorities.

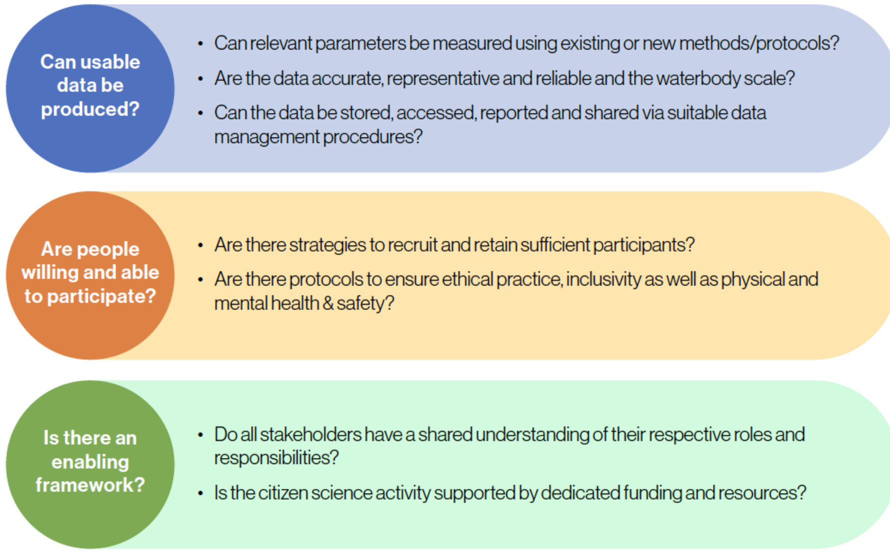

Figure 2: Checklist of requirements for using citizen science for monitoring indicator 6.3.2 (WWQA,2024)

Data Suitability

Citizen-generated data must meet the technical requirements of SDG Indicator 6.3.2. Measurements must be taken at locations that represent ‘water bodies’ which are defined as either small sections/tributaries of a river, a lake, or an aquifer. For water body classification purposes (good versus not good), the measured value must be comparable to a standard or target value that represents ‘good ambient water quality’. And it is important to recognise that not all citizen science methods are suitably sensitive to measure ecologically-sensitive concentrations, or the method may lack the precision to determine whether a target has been met or not. In addition quality assurance and quality control (QA/QC) must be embedded in all sampling activities.

Effective citizen science projects need strong data management systems that follow FAIR principles. This means data should be Findable, Accessible, Interoperable, and Reusable. Countries that want to use citizen-generated data for SDG reporting must also have protocols that track data provenance and ensure compatibility with national datasets. National authorities must ensure that metadata standards are agreed, ensuring that there is compatibility between citizen and national authority datasets. Lastly, projects must choose technologies that fit the sampling context and ensure time and location stamps are captured reliably. This can be hampered in remote areas by limited internet connectivity causing difficulty in transmitting data.

Participant Capacity and Motivation

Citizen science depends on people. Successful citizen science projects rely on strong recruitment and long-term retention of participants. People join and stay involved for many different reasons, and these motivations vary across communities and can change over time. Understanding what drives participation and ensuring volunteers feel safe, supported, and satisfied, is essential, because they are integral to the project.

National authorities should be cognisant that motivations vary across cultures and change over time, and it is essential that volunteers feel supported, and valued throughout their engagement. Thorough training and ongoing communication are essential components of any successful initiative, and when looking to integrate an existing project, these factors should be assessed thoroughly.

Enabling Framework

Citizen science can only contribute to national water quality management and SDG Indicator 6.3.2 reporting if supported by appropriate institutional structures. This requires that there are governance structures in place that define clear roles and responsibilities and that there are mechanisms for data sharing established. A worthy long-term goal could be that any new approach aligns with national water governance structures that could involve agreements between authorities and third-party project coordinators such as NGOs and form part of the national water resource management policy.

Each governance style has advantages: top-down models offer stronger control and standardisation, while bottom-up models allow volunteers to contribute local knowledge, skills, and priorities that can enrich water resource management. Regardless of the structure, it is essential that all parties have clearly defined and transparent roles and responsibilities.

Citizen science is not cost-free. Funding is needed for: equipment; recruitment; training; communication; feedback; and to support volunteers. Because funding can often be short-term or project-based, many water-quality citizen science initiatives struggle with financial sustainability. Long-term funding strategies are therefore essential, especially for projects contributing to SDG monitoring. Long-term projects could be funded through the national authorities' monitoring budget; international agencies, NGOs, or private sector partners.

Choosing Your Development Pathway

Once the preconditions are understood, national authorities can identify which of the four pathways best reflects their current context. Efforts to develop an integrated monitoring programme (national authority plus citizen) require robust planning that follows established design principles. Countries differ widely in their monitoring capacity and citizen science landscape. Four pathways help national authorities identify the most appropriate approach.

The Four Pathways

Pathway 1: National Authority Data and Citizen Science Data Available

If the national authority operates an advanced monitoring programme and there are active citizen science programmes that are collecting data that are suitable for SDG Indicator 6.3.2 reporting, efforts should focus on connecting the two data streams to provide the most comprehensive data coverage possible.

Citizen science can enhance national authority datasets by expanding spatial and temporal coverage. Volunteers often have valuable local knowledge that supports water resource management. When both data sources exist, the priority is to build a strong framework linking citizen science initiatives with national authorities. This includes integrating datasets, ensuring projects provide clear, accessible metadata, and establishing mechanisms that build trust in using all available data. Support may be needed to help citizen science groups participate, with clear roles for all stakeholders. Co-designing the framework with project coordinators and volunteers is essential.

Pathway 2: National Authority Data Available, No Citizen Science Activities

When national authority data are strong but citizen science data are absent or limited, initiating citizen science programmes to dovetail with the national authority programme should be prioritised. Citizen science can help expand monitoring coverage while engaging the public in water resource management. This scenario allows targeted data collection from priority areas that are under-represented in the national monitoring programme. New initiatives should be designed to complement existing networks, with careful attention to sampling locations and methods.

Citizen science can be especially useful for reaching remote sites. Strong support will be needed to recruit and retain volunteers, and governance structures must be defined—whether projects are run by the national authority or by third parties with official backing. Co-design with volunteers is strongly encouraged to ensure long-term participation.

Pathway 3: Limited National Authority Data, Active Citizen Science

When citizen science projects are well established but national authority monitoring capacity is limited, strengthening national authority systems should remain a priority. Citizen science can provide highly valuable data if it meets SDG Indicator 6.3.2 requirements. Authorities should clearly communicate their data needs to project coordinators, offer guidance on scientific standards, and provide resources to help projects adapt and remain sustainable. Data management processes may also be needed to ensure information flows efficiently to the national authority.

Beyond data contributions, these projects should be considered in a broader context. Even when their data are not directly usable, they still support SDG 6 by engaging the public in water resource management. Their individual aims should be respected, as they may hold value even if they do not fully align with national monitoring priorities.

Pathway 4: Limited National Authority Data, No Citizen Science

When overall monitoring is limited, rapid expansion of capacity is essential. Citizen science can quickly add new monitoring sites and can be developed alongside national authority efforts, allowing for a coordinated, strategic approach. Citizen science locations and methods can be tailored to fill gaps in national monitoring or to engage specific communities in water management. Recruiting and retaining volunteers is crucial, so programmes should be designed to support long-term participation. Efforts should initially focus on a single river or lake basin to ensure protocols and methods are well established before further expansion.

Table 1 below summaries the goals, design priorities and roles of both the national authority and citizen science activity based on each of the four development pathways. Regardless of which pathway is adopted the national authority should remain central coordination responsibility.

Table 1: Description of goals, design priorities and roles based on each of the four development pathways

Path-way	Context	Primary Goal	Design Priorities	Citizen Science Role	National Authority Role
1	Both datasets already exist	Integrate datasets to improve coverage and quality	Map and align datasets Harmonise methods & QA/QC Integrate data systems Fill spatial/temporal gaps	Strengthen existing networks; Align methods; Increase frequency and coverage	Lead integration; Provide QA/QC; Use citizen data in SDG reporting
2	Strong national monitoring; no citizen science yet	Design citizen science to complement national network	Identify gaps citizen science can fill Build partnerships Develop simple, aligned protocols Create data pathways	Provide coverage in remote/under-monitored areas; Increase frequency; Support early warning	Train and support volunteers; Integrate citizen data progressively
3	Weak national monitoring; strong citizen science presence	Upgrade and integrate citizen data; rebuild national capacity	Assess citizen data quality Align methods with SDG 6.3.2 Establish tiered data system Strengthen authority capacity	Provide core spatial/temporal coverage; Upgrade methods; Supply contextual data	Build SDG-compliant network; Validate and integrate citizen data
4	Very limited monitoring	Build foundational monitoring system with parallel citizen science	Establish core national network Launch small citizen pilot Develop scalable protocols Build basic data systems	Pilot small, well-supported groups; Fill critical gaps; Build community engagement	Lead system design; Train volunteers; Build long-term monitoring capacity

Designing an Integrated Monitoring Programme (Phase 1)

Regardless of pathway, all monitoring programmes must follow core design principles which are listed below.

Technical Design

A well-designed monitoring programme begins with a clear understanding of what information is needed and how it will be collected. This stage establishes the scientific foundation of the programme by defining objectives, selecting appropriate monitoring locations, and identifying the data required to meet national reporting needs.

Define Objectives and Information Needs

Defining objectives and information needs is an essential first step to any monitoring programme design. This will require the defined information needs to be matched to the current water quality monitoring and assessment capacity. Initial questions could be targeted to help understand those pressures related to agriculture, wastewater and climate.

Review Existing Capacity

An initial review of the national authority's current capacity should include an assessment of the current monitoring sites, the parameters being measured and the frequency of data collection. Similarly a review of existing citizen science initiatives should include collection of similar information. To support this assessment, projects with global coverage include Freshwater Watch[6] and miniSASS[7]. A new UNEP portal that maps all citizen science water quality initiatives is being developed on the SDG Water Quality Hub. In addition, UNESCO's IHP WINS Citizens4Water Platform[8] catalogues existing water-related activities. A full review of the institutional capacity should be performed to identify the scope for new workload to be incorporated into existing workplans and commitments.

Design the Monitoring Network

Water quality long-term trend monitoring requires a record of relatively consistent data for the same places, and at the same frequencies, for a number of years. Following the criteria for optimal monitoring locations to generate suitable data for SDG Indicator 6.3.2 reporting include:

- at last one monitoring location per water body;
- monitoring locations are situated at an intersection between a river and a road;
- safe access;
- co-location with existing hydrological stations if present;
- not being close to a known point sources of pollution; and,
- representative of impacted and unimpacted catchment areas.

Designing the actual monitoring network is key aspect of the design phase and specific guidance on this is available in the SDG Indicator 6.3.2 Technical Document on Monitoring Programme Design[9].

[6] https://www.freshwaterwatch.org
[7] https://minisass.org
[8] https://ihp-wins.unesco.org/citizens4water/
[9] https://wwqa.info/wp-content/uploads/2025/08/SDG632_Monitoring-Programme_Design_20200413.pdf

Partnership Design

Effective integration of citizen science depends on strong, well-supported partnerships between national authorities and community participants. This stage focuses on identifying suitable networks, developing fair and inclusive recruitment strategies, and ensuring that ethical considerations guide all interactions with volunteers.

Identify and Engage Citizen Scientist Networks

Depending on which of the four pathways being followed, it will be necessary to perform an analysis of existing citizen scientist networks (Pathways 1 & 3), or identify potential partners that could serve as the basis for the network (Pathways 2 & 4). It will be necessary to perform an analysis of their current activities and assessing whether these are suitable in their current form, or whether additional activities are needed.

Potential existing partner networks that could be explored for Pathways 2 & 4 include: water user associations (as in Kenya, Tanzania, Uganda); NGOs (WWF Zambia); schools (South Africa); Community groups (United Kingdom); or gauge readers (Malawi)[10].

Recruitment and Retention Strategy

The citizen scientist recruitment strategy will be guided by the pathway being followed and the monitoring programme design but it is essential that citizen scientists are identified near the desired monitoring locations, so that the burden of collecting routine and regular data is reduced.

Regular and continuous engagement is needed to maintain interest of the citizen scientists. This is usually achieved by hosting workshops and establishing social media groups. The equipment and tools provided to the citizen scientists should be well planned and matched to needs and the budget. For example, in addition to the monitoring equipment needed to collect the data, citizen scientists are often provided with personal protective equipment (PPE, for example, gloves and boots), branded clothing (hats and t-shirts), and the means collect and transmit the data collected (mobile phones and airtime).

An essential component to long-term retainment is the provision of feedback to the citizen scientists on the results of the data collected and how this translates into local information. Developing tailored feedback results that for the citizen scientists that they can in turn share within the community has proved successful (Annex 1).

Citizen science must be implemented ethically with a focus on volunteer safety, data privacy, managing expectations and ensuring equity and inclusion. The design phase is the opportunity to ensure these are given due consideration. For example ensuring safe access to sampling sites, provision of PPE and how safety instructions will be communicated. Only essential personal information should be collected and any information gathered should be stored securely and only after obtaining consent. From initial contact with citizen scientists, transparency about how data will be used should be made clear, and steps to avoid raising expectations of immediate local improvements are essential. Designing in fora for feedback from the citizen scientists will help to maintain trust.

The recruitment strategy should ensure participation opportunities are accessible to women, youth, and marginalised groups, and avoiding extractive practices where communities contribute data but receive no benefits are essential.

[10] A selection of case studies are available on the WWQA Citizen Science for SDG 632 website: https://wwqa.info/workstreams/citizen-science/

Operational Design

Turning a monitoring programme into a functioning system requires careful planning of the practical elements that enable consistent data collection. This stage covers the tools, training, and data management processes needed to ensure that both national staff and citizen scientists can collect, handle, and share data reliably.

Equipment, Tools, and Training

The equipment provided will be dependant on the method or approach being used, but ensuring that these are used effectively requires both the national authority staff and the citizen scientists being trained. Developing a standard operating procedure (SOP) that explicitly outlines the training requirements and the review process is a useful tool for quality assurance.

A useful approach is that of 'train the trainer' - the supplier of the kits or method being used provides training to the national authority staff who then in turn train the volunteers.

Data Management and Integration

Establishing data management protocols by agreeing to data metadata standards will help ensure compatibility between citizen and national datasets. It is also critical at this design phase that a plan is established for storage, analysis, and archiving of the data collected.

This should also include a plan for how the data will be analysed and assessed in order to ensure that all the necessary information is collected during the implementation phase.

Implementation (Phase 2)

The implementation phase begins once planning, training, and preparation are complete. It covers all activities carried out by national authority staff and citizen scientists during routine monitoring, including sampling, analysis, data handling, and ongoing quality assurance. This phase is where the monitoring programme becomes operational and where the collaboration between authorities and volunteers is most visible.

Training and Capacity Building

Before field activities begin, all participants—both national authority staff and citizen scientists—should receive practical, hands-on training. This should include:

- Sampling techniques for each parameter
- Use and care of equipment, including calibration where relevant
- Data recording procedures, whether digital or paper-based
- QA/QC expectations, such as duplicate sampling or photo documentation
- Health and safety protocols for fieldwork
- Communication channels for reporting issues or seeking support

Refresher training should be offered periodically, especially when new volunteers join or methods are updated.

Equipment Preparation and Distribution

Before fieldwork begins, all equipment must be checked, prepared, and distributed. Sampling kits, test strips, meters, bottles, and personal protective equipment need to be inspected to ensure they are functional and safe to use. Calibration checks may be required for certain instruments, and consumables should be replenished as needed. National authorities often maintain an inventory system to track equipment and ensure that volunteers can easily replace items or request additional supplies. Clear guidance on storage, maintenance, and troubleshooting helps keep equipment in good working order throughout the monitoring period.

Field Sampling Activities

Once trained and equipped, participants begin routine sampling according to the standard operating procedures established during the design phase. Fieldwork involves selecting safe and representative sampling points, collecting samples consistently, and recording relevant environmental conditions such as weather, flow, or recent rainfall. In many cases, volunteers take photographs to document sampling conditions or results. Depending on the programme design, analysis may occur directly in the field using portable kits, in community hubs where volunteers work together, or in laboratories for parameters requiring higher precision. Regardless of where analysis takes place, consistency in method is essential to ensure that data from different sites and contributors can be compared reliably.

Data Recording and Storage

Accurate and timely data recording is central to the success of Phase 2. Participants enter results using the agreed system—whether a mobile application, online form, SMS platform, or paper sheet that is later digitised. National authorities are responsible for ensuring that data flow smoothly into a centralised database where they can be reviewed and stored securely. Regular checks help identify missing information, unusual values, or potential errors, allowing issues to be resolved quickly and maintaining the integrity of the dataset.

Quality Assurance and Quality Control (QA/QC)

Quality assurance and quality control continue throughout the implementation phase. Duplicate sampling with national authority staff, periodic calibration checks, and the review of photographic evidence all contribute to maintaining confidence in the data. Automated validation tools can flag outliers or inconsistencies, while periodic audits provide an additional layer of oversight. Importantly, feedback should be shared with volunteers so they understand how their data are being used and how any quality issues are addressed. This not only improves data quality but also strengthens volunteer engagement..

Health, Safety, and Welfare

Health and safety must remain a priority during all field activities. Participants should be equipped with appropriate protective gear such as gloves, high-visibility clothing, and sturdy footwear. A first aid kit should accompany every field visit, and sampling locations should be assessed for hazards such as steep banks, fast currents, or polluted areas. Working in pairs or groups is strongly encouraged, but when lone working cannot be avoided, strict check-in procedures and emergency response plans must be in place. Clear guidance should also be provided on when sampling should not take place, such as during storms, floods, or other unsafe conditions.

Ongoing Support and Communication

Throughout the implementation phase, strong communication between national authorities and citizen scientists is essential. Coordinators should provide timely responses to questions, share updates on programme progress, and offer support when equipment or methods present challenges. Recognising volunteer contributions and keeping participants informed about how their data contribute to national reporting helps maintain motivation and strengthens the partnership between communities and authorities.

Assessment, Reporting, and Management (Phase 3)

Phase 3 focuses on transforming the data generated during implementation into meaningful insights, official SDG reporting outputs, and actionable management responses. This phase closes the monitoring cycle by evaluating whether the programme has met its objectives and by identifying improvements for future cycles. It is also the stage where citizen-generated data and national authority data come together to inform decision-making at water body, basin, and national scales.

Assessment of Water Quality Data

The first step is to review and validate the incoming data to ensure it is complete, consistent, and reliable. National authorities examine the dataset for missing entries, unusual values, or inconsistencies, drawing on the QA/QC procedures established earlier in the programme. This process helps confirm that the information is robust enough to support classification and reporting.

Once validated, the data are analysed to understand the condition of each monitored water body. This involves calculating summary statistics, identifying trends, and examining spatial patterns across the monitoring network. The analysis is strengthened by integrating water quality results with supporting information such as hydrological conditions, land use patterns, known pollution sources, and recent weather events. Bringing these elements together helps build a clearer picture of the pressures affecting each water body and the likely drivers of observed changes.

A key outcome of the assessment stage is the classification of water bodies according to the SDG Indicator 6.3.2 methodology (see indicator calculation section below). Using the agreed parameters and integration approach, each water body is assessed as either “good” or “not good.” Where both national authority and citizen-generated data are available, the chosen method for combining datasets—whether equal weighting, weighted approaches, or median-based methods—is applied consistently. This ensures transparency and comparability across reporting cycles.

Management Actions and Adaptive Planning

The final component of Phase 3 focuses on using the results of the assessment to inform water resource management. National authorities review whether the monitoring programme has met the objectives set during the design phase. This includes evaluating whether the data collected were sufficient to classify water bodies confidently, whether the monitoring network provided adequate spatial and temporal coverage, and whether citizen science contributions strengthened the overall evidence base.

Based on this review, authorities identify gaps or areas for improvement. These may include water bodies that require additional monitoring, parameters that need higher-precision methods, or geographic areas where citizen science could be expanded. The assessment may also highlight training needs, equipment limitations, or opportunities to streamline data management systems.

Importantly, the results of the monitoring programme should feed directly into management decisions. Authorities may use the findings to prioritise pollution control measures, update catchment management plans, or engage with communities and stakeholders in areas where water quality is declining. The data can also help evaluate the effectiveness of previous interventions, providing evidence on whether management actions are achieving their intended outcomes.

Calculating SDG Indicator 6.3.2

Integrating citizen-generated data into SDG Indicator 6.3.2 reporting requires a clear and transparent approach to combining measurements from different sources. National authorities may receive data collected by their own monitoring teams, by partner organisations, or by citizen scientists using a range of methods. To ensure consistency and credibility, countries should adopt a defined integration strategy that reflects the characteristics of the available datasets.

Three main approaches can be used to combine citizen-generated and national authority data at the water body level:

Equal Weighting: all measurements regardless of whether they were collected by national authorities or citizen scientists are treated as equal. This method is most appropriate when:

- citizen science methods have been validated against professional methods;
- QA/QC procedures are well established;
- sampling frequencies are similar across data sources; and when
- there is confidence in the comparability of results.

Equal weighting is simple to apply and maximises the contribution of citizen-generated data, particularly in locations where national authority sampling is infrequent.

Higher Weighting for National Authority Data: in cases where national authority data may be given greater weight in the final classification. This approach may be suitable when:

- national authority methods have higher analytical precision;
- citizen science methods are newer or still being validated; and when,
- there is uncertainty about the consistency of volunteer measurements.

Weighting can be applied statistically, for example assigning a higher weight to national authority values, or procedurally for example, using national authority data as the primary dataset and citizen data as supplementary evidence.

Median of Multiple Citizen Measurements: used where citizen science programmes collect data at a much higher frequency than national authorities. The median of several citizen measurements can be used to generate a single representative value for a given period. This approach helps to:

- reduce the influence of outliers;
- smooth variability caused by differing sampling times; and,
- provide a robust estimate when data density is high.

The median value can then be combined with national authority measurements using either equal or weighted approaches.

Citizen-generated data may contribute to Level 1 or Level 2 submissions depending on the parameters measured and the methods used. Citizen science data can be used for Level 1 reporting if they are based on *in situ* measurements of the five core parameters (nitrogen, phosphorus, dissolved oxygen, pH, electrical conductivity) and meet indicator requirements. Citizen science data using biological indicators, turbidity, metals, macroplastics, or other alternative approaches can be included as part of a Level 2 submission.

In both cases, the integration method should be selected to ensure that the final classification of water bodies is scientifically robust and aligned with [SDG Indicator 6.3.2 methodology](https://wwqa.info/wp-content/uploads/2025/08/SDG632_Introduction-to-the-Methodology_20230420.pdf)[11].

[11] https://wwqa.info/wp-content/uploads/2025/08/SDG632_Introduction-to-the-Methodology_20230420.pdf

Suggested Implementation Timeline

Each national situation is different, but a typical timeline for establishing an integrated monitoring programme could follow the phases outline in Figure 3 below. This timeline starts from the initial design phase and definition of objectives through to planning for expansion and upscaling of the initiative from year two onwards.

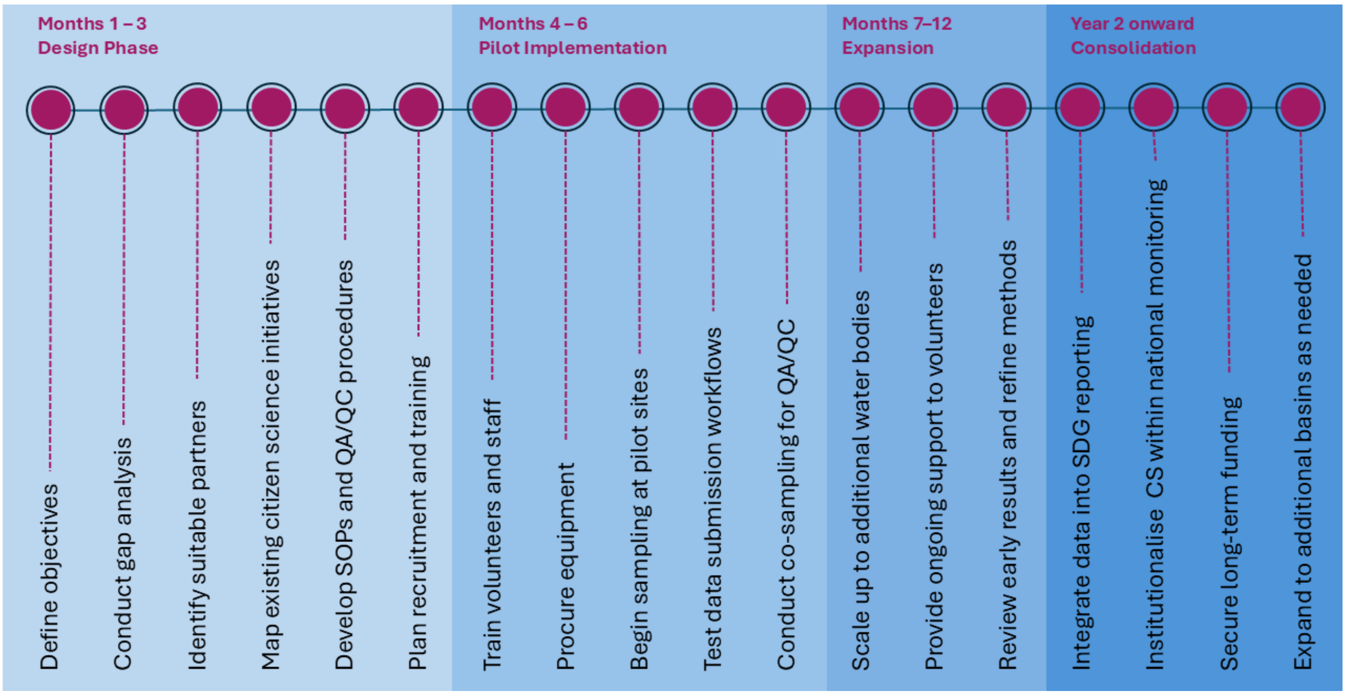

Figure 3: Suggested timeline for development and integration of citizen science monitoring into national monitoring systems

Next Steps for National Authorities

Integrating citizen-generated data into national water quality monitoring programmes and for SDG Indicator 6.3.2 reporting requires planning, coordination, and sustained engagement. The following steps outline how national authorities can begin this process and build a strong foundation for long-term collaboration with citizen science initiatives.

Nominate a focal point for citizen science: A designated focal point within the national authority is essential for coordinating all activities related to citizen science. This person should have: a clear mandate to explore and develop citizen science opportunities; the authority to liaise with internal departments and external partners; and, an understanding of national monitoring priorities and SDG indicator 6.3.2 requirements.

The focal point becomes the central contact for project coordinators, volunteers, and international partners, ensuring continuity and coherence.

Identify the most appropriate development pathway: Using the four pathways described in this guideline, the focal point should assess the national context and determine which pathway best reflects current monitoring capacity and citizen science activity. Selecting the correct pathway ensures that resources are used efficiently and that expectations are realistic.

Review national monitoring capacity: A structured review of existing monitoring systems is essential. This assessment helps identify gaps that citizen science could help fill and highlights areas where national systems may need strengthening.

Map Existing citizen science initiatives: National authorities should identify and assess any citizen science projects already operating in the country. This mapping exercise should consider:

- Geographic coverage
- Parameters measured
- Methods used and their alignment with SDG Indicator 6.3.2
- Organisational capacity and sustainability
- Volunteer networks and community engagement

Understanding the existing landscape helps avoid duplication, builds on local strengths, and identifies potential partners.

Establish collaborations with project coordinators: Once potential partners are identified, national authorities should initiate dialogue with project coordinators to explore opportunities for collaboration. Collaborative planning ensures that citizen science activities are aligned with national priorities and that volunteers receive the support they need.

Plan resources for design, engagement, and data management: Successful integration of citizen science requires adequate resources. Resource planning should be realistic and aligned with the chosen pathway, ensuring that both national authorities and citizen scientists can participate effectively.

SUMMARY

This guideline presents a practical approach for integrating citizen science into national water quality monitoring and SDG Indicator 6.3.2 reporting. By combining official monitoring with community-generated data, countries can expand the reach, frequency, and relevance of their water quality assessments.

Citizen science offers significant potential to transform how water quality is monitored. It can dramatically increase spatial coverage, strengthen public engagement, and provide valuable insights that complement national datasets. With appropriate training, clear methods, and strong quality assurance, citizen-generated data can meet the standards required for national and global reporting.

The four development pathways outlined in this document allow countries to begin from their current level of capacity—whether strong or limited—and build a monitoring system that is inclusive, resilient, and scientifically robust. Ultimately, integrating citizen science strengthens evidence-based decision-making, supports more effective water resource management, and helps track progress toward achieving SDG 6.3.2.

Integrating citizen science into national water quality monitoring offers countries a practical and scalable way to strengthen their evidence base, expand coverage, and engage communities in safeguarding freshwater resources. By combining the strengths of national authority systems with the reach and enthusiasm of trained volunteers, countries can build monitoring programmes that are more inclusive, more resilient, and better aligned with the ambitions of SDG Indicator 6.3.2. This guideline provides a clear pathway for achieving that integration and for turning shared data into meaningful action for improved water quality.

Further Information

Below are a list of resources that elaborate on the concepts presented.

Relevant SDG Methodology and Technical Documents

- SDG Indicator 6.3.2 Introductory document: https://wwqa.info/wp-content/uploads/2025/08/SDG632_Introduction-to-the-Methodology_20230420.pdf
- SDG Indicator 6.3.2 Level 2 Technical document: https://wwqa.info/wp-content/uploads/2025/08/SDG632_Level2_Reporting_20230418.pdf
- WWQA CS for SDG 632 Website: https://wwqa.info/workstreams/citizen-science/
- WWQA CS Policy Brief: https://zenodo.org/records/12650972
- WWQA Technical Brief: https://zenodo.org/records/12634359
- SDG Water Quality Hub: https://www.sdg632hub.org
- Freshwater Watch Website: https://www.freshwaterwatch.org
- miniSASS Website: https://minisass.org

For all queries about this indicator please contact UNEP's SDG 632 Help Desk at sdg632@un.org.

ANNEX 1: EXAMPLE OF PROJECT-SPECIFIC FEEDBACK FROM EARTHWATCH