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Seventh Meeting of the Scientific and Technical Advisory Committee (STAC) to the Protocol Concerning Pollution from Land-Based Sources and Activities in the Wider Caribbean.

Virtual, 22 – 25 July 2025

**RESPONSE REPORT: NEEDS ASSESSMENT SURVEY – US EPA PROJECT ON WATER  
QUALITY IN THE WIDER CARIBBEAN REGION**

***This meeting is convened virtually. Delegates are kindly requested to access all meeting documents electronically for downloading as necessary.***

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## UNEP-US/EPA Capacity Development Project on Water Quality in the Wider Caribbean Region

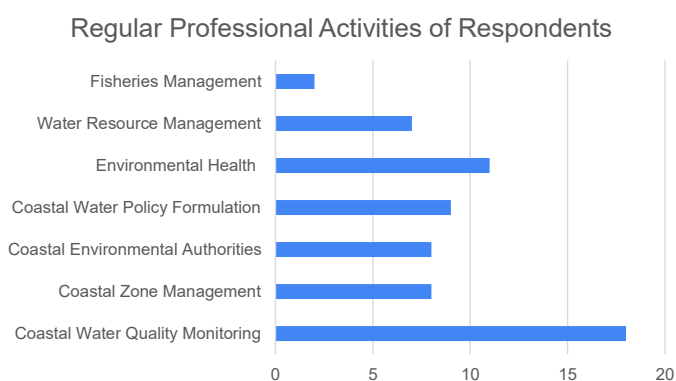
### Response Report: Needs Assessment Survey

At the start of 2025, the project's needs assessment survey was distributed to focal points of the LBS Protocol across the Wider Caribbean Region (WCR) with the objective of assessing specific needs to address capacity gaps and challenges in water quality monitoring and management as well as pollution reduction and prevention. Created with Google Forms and available in both [English](#) and [Spanish](#), the survey was first disseminated on January 3<sup>rd</sup> with a deadline of January 24<sup>th</sup> that was eventually extended to February 6<sup>th</sup>. The survey was aimed at professionals working in **coastal water quality monitoring, coastal zone management, coastal environmental authorities, coastal water policy formulation, environmental health agencies, water resource agencies and fisheries departments**. Respondents were informed that if they feel a question is outside their expertise, they may skip it or answer "I don't know." Countries were also welcomed to submit multiple responses to the survey.

Responses were received from 22 individuals located in 19 countries of the WCR, including Antigua & Barbuda, Aruba, Barbados, Belize, Colombia, Costa Rica, Cuba, Dominican Republic, Guyana, Honduras, Jamaica, Mexico, Panama, Saint Lucia, St. Kitts & Nevis, Suriname, Trinidad & Tobago, USA, and Venezuela. The number of responses is considered to be substantial as it accounts for 68% of the region's 28 Member States.

It is important to acknowledge that not all respondents were in a position to provide an official response on behalf of their countries. Instead, they contributed insights based on their personal perspectives as professionals working in the region. Thus, the survey results should generally be considered as reflections of individual viewpoints within the WCR, rather than formal country responses. All open-text responses are presented verbatim, with Spanish responses translated into English.

Most responses (17 of 22) were provided by individuals working in government agencies. The remainder were submitted by individuals from national research institutes (IMA, Trinidad & Tobago; CIMAB, Cuba; INVEMAR, Colombia), a non-profit organization (WaterWays, Saint Lucia), and a university (Universidad Nacional, Costa Rica). In terms of their regular professional activities, nearly all respondents work in coastal water quality monitoring, while 7-11 also work in coastal zone management, coastal environmental authorities, coastal water policy formulation, environmental health, and water resource management.



The following analysis addresses the responses received for each of the survey's 13 sections.

- |  |  |
|--|--|
| 1. <a href="#">General Capacity Development Needs</a>      | 8. <a href="#">Financial, Infrastructure &amp; Human Resources</a> |
| 2. <a href="#">Coastal Water Quality Monitoring Design</a> | 9. <a href="#">Informing Decision-Makers</a>                       |
| 3. <a href="#">Water Quality Sampling</a>                  | 10. <a href="#">Pollution Source Management</a>                    |
| 4. <a href="#">In Situ Analyses</a>                        | 11. <a href="#">Policy Formulation</a>                             |
| 5. <a href="#">Laboratory Analyses</a>                     | 12. <a href="#">Public Awareness</a>                               |
| 6. <a href="#">Data Management &amp; Analysis</a>          | 13. <a href="#">Gender</a>   |
| 7. <a href="#">Reporting of Results</a>                    | 14. <a href="#">Annex</a>  |

## **Section 1: General Capacity Development Needs**

### *Summary*

The survey found that the primary challenges in conducting coastal and marine water quality monitoring were closely related to funding limitations. While 'funding' itself was selected by nearly all participants, the next most selected primary challenges (infrastructure, access to equipment, geographic coverage of monitoring) can all be related directly to funding limitations, rather than knowledge or skills. However, the top training needs identified all related closely to knowledge and skills. The most commonly described training needs were field sampling and laboratory analysis (16); complementary monitoring approaches (13); data management, analysis and sharing (12); and communication of findings (8). The latter two training needs aligned with the top two selected options of LMS modules of most interest: reporting (19) and data management & analysis (17). Other popular LMS modules included the design of coastal water quality monitoring programs (15) and monitoring and prevention of plastic pollution, including microplastics (14).

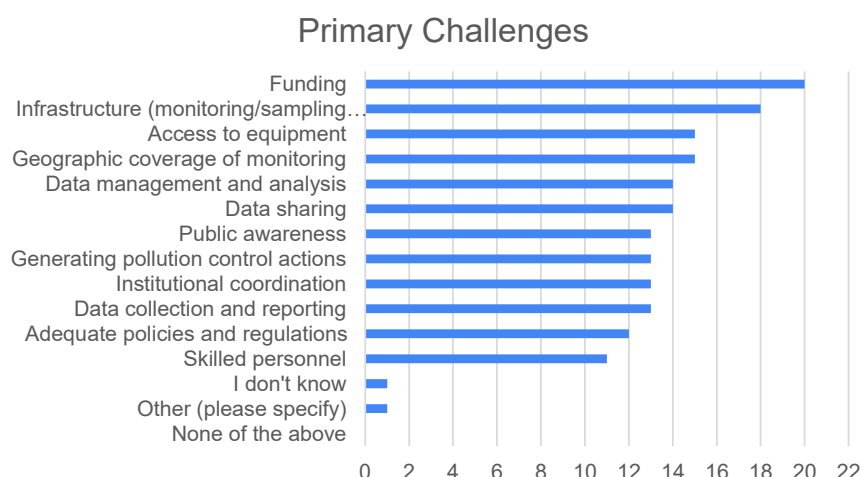
Primary Challenges	TOTAL
Funding	20
Infrastructure (monitoring/sampling stations, etc.)	18
Access to equipment	15
Geographic coverage of monitoring	15
Top Training Needs	TOTAL
Field Sampling & Laboratory Analysis (harmonized protocols)	16
Complementary Monitoring Approaches (e.g. real-time monitoring, remote sensing)	13
Data Management, Analysis and Sharing	12
Communication of Findings (e.g. public awareness, reporting to decision makers)	8

LMS Modules of Most Interest	TOTAL
Reporting	19
Data management & analysis	17
Coastal water quality monitoring program design	15
Monitoring and prevention of plastic pollution (incl. microplastics)	14

### Individual Questions

1. In your opinion, what are the overall primary challenges in conducting coastal water quality monitoring in your country? (Choose all that apply)

Various challenges in conducting coastal water quality monitoring were identified in each country. Over 90% of respondents identified funding as a primary challenge, followed by infrastructure (82%). The rest of the options were selected by 50-68% of respondents, including access to equipment, the geographic coverage of monitoring stations, data management and analysis, data sharing, public awareness, generating pollution control actions, institutional coordination, data collection and reporting, adequate policies and regulations, and skilled personnel. Additionally, one respondent noted that these challenges vary between different parts of their country.



2. What types of capacity development trainings could be beneficial to strengthen capacities in water quality monitoring and management as well as pollution reduction and prevention in your country? (Open text response)

The subject of field sampling and laboratory analysis was most frequently mentioned (16 of 22 responses), with water quality sampling methods and laboratory analysis each receiving nine and eight specific mentions, respectively, followed by five mentions of harmonized monitoring protocols. The need for monitoring approaches that are complementary, or alternatives, to traditional water quality monitoring programmes was mentioned by 13 of 22 respondents. Examples included real-time monitoring (4), remote sensing applications (3), and citizen science approaches (2). Data management, analysis and sharing was identified by 12 respondents as a training need, with eight specific mentions of data analysis and interpretation and five specific mentions of data processing and management. Eight respondents highlighted the need for training in the

communication of findings from their water quality monitoring programs, mentioning community engagement (4), raising public awareness (3), and reporting to decision-makers (2). Other identified training needs referred to strengthening legislation & regulations (4), institutional strengthening (4), pollution control (4), and integrated water resources & coastal management (2).

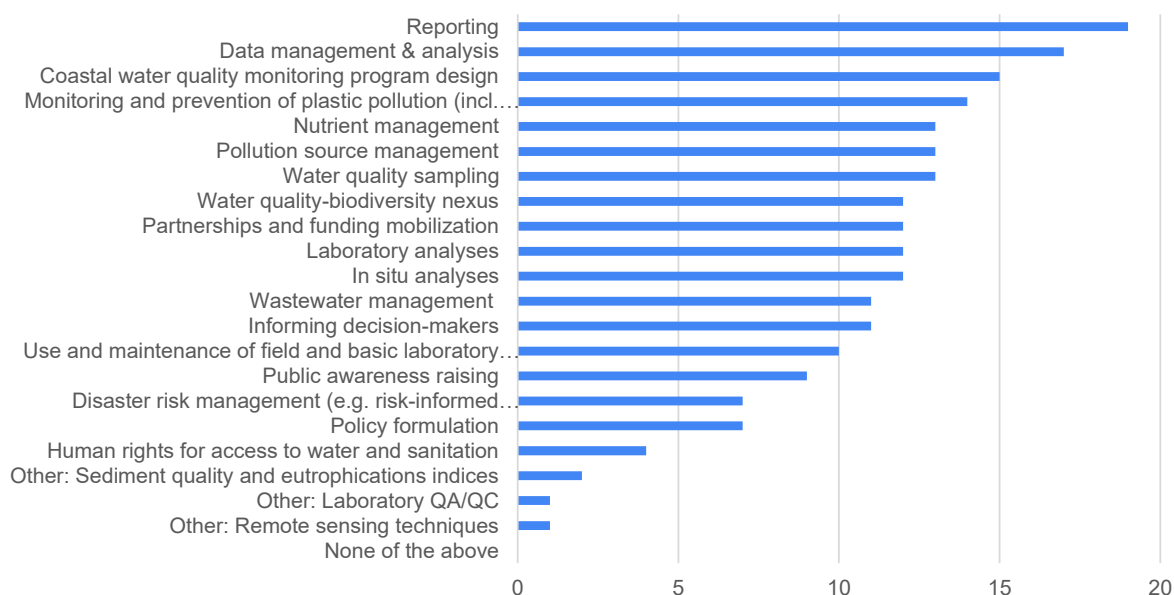
Training Need	Mentions
<b>Field Sampling and Laboratory Analysis</b>	16
Water quality sampling methods	9
Laboratory analysis (physicochemical, microbiological)	8
Harmonized monitoring protocols	5
Emerging contaminants (microplastics, POPs, pharmaceuticals)	3
Taxonomic identification (HABs, plankton, macroinvertebrates)	2
Coral reef water quality monitoring	2
Laboratory quality control	1
<b>Complementary Monitoring Approaches</b>	13
Real-time monitoring	4
Remote sensing applications	3
Citizen science approaches	2
Ecotoxicology	1
Early warning systems	1
Advanced technology and innovation	1
Microbial source tracking	1
Low-cost monitoring approaches	1
<b>Data Management, Analysis and Sharing</b>	12
Data analysis and interpretation	8
Data processing and management	5
GIS analysis	2
Data sharing across platforms	2
<b>Communication of Findings</b>	8
Community engagement in water quality efforts	4
Raising public awareness on water pollution	3
Reporting to decision-makers	2
<b>Strengthening legislation &amp; regulations</b>	4
Strengthening policy design for environmental control	4
Development of water quality standards	1
<b>Institutional Strengthening</b>	4
Strengthening government laboratories & personnel	2
Identifying funding mechanisms	2
<b>Pollution Control</b>	4
Wastewater treatment (domestic & industrial)	3
Solid waste management	2
Zero waster and circular economy approaches	1
Emergency response planning (oil spills, disasters)	1
Improved fishing practices	1

Assessment of touristic carrying capacity	1
<b>Integrated Water Resources &amp; Coastal Management</b>	<b>2</b>
Coastal zone management	1
Integrated water resource management	1

3. If given the opportunity for capacity development through an online Learning Management System related to water quality, which of the following course modules would you be most interested in accessing? (Choose all that apply)

Given the opportunity for capacity development through an online Learning Management System related to water quality, respondents most frequently selected reporting (19 of 22), data management & analysis (17), coastal water quality monitoring program design (15), and monitoring and prevention of plastic pollution (14). Thirteen respondents selected water quality sampling, pollution source management, and nutrient management. Twelve respondents selected in situ analyses, laboratory analyses, partnerships & funding mobilization, and the water quality-biodiversity nexus. Eleven respondents selected informing decision-makers and wastewater management.

LMS Modules of Most Interest



4. Regarding your choices in question #3, please provide specific information about what exactly you would like the online modules to focus on. This would allow us to better shape the contents of the modules. (Open text response)

When asked to provide specific information about what exactly they would like the online modules to focus on regarding their choices in question #3, respondents offered the following insights with respect to the modules in the previous question:

Module(s)	Specific Insights
<ul style="list-style-type: none"> <li>• Reporting</li> <li>• Informing decision makers</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening/developing a science-policy guideline is important</li> <li>• Preparation of informative material aimed at decision makers</li> <li>• It would be very interesting to know what decision-makers need, how the results should be presented to them, the best way to focus/communicate the results in such a way that they are not incorrectly understood or exposed to the media.</li> </ul>
Data management & analysis	<ul style="list-style-type: none"> <li>• Analyzing water quality data using all the relevant mathematical tools to interpret and present data. That is, understanding how to apply the relevant techniques and why.</li> <li>• Data analysis focusing on statistics</li> <li>• Information must be provided that guarantees good monitoring, good management of the data and how to analyze and show the results (fundamental), and that these reach the decision-makers.</li> </ul>
Coastal water quality monitoring program design	<ul style="list-style-type: none"> <li>• Use of geospatial and statistical tools for the design of environmental monitoring</li> <li>• Design of a coastal water monitoring network, including the main coastal water quality indicators.</li> </ul>
<ul style="list-style-type: none"> <li>• Water quality sampling</li> <li>• In situ analyses</li> <li>• Laboratory analyses</li> <li>• Use and maintenance of field and basic laboratory equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Online modules are good for background and orientation, but practical skills sessions are also necessary to ensure adequate capacity building. For example, sampling, lab processing, appropriate shipping/transportation/preservation, and lab and equipment calibration.</li> <li>• Harmonised technical aspects to ensure the most reliable and robust methods are used.</li> <li>• Collection of environmental samples, on-site analysis and laboratory analysis with standardized methods and based on a management system under ISO17025 requirements.</li> <li>• The modules must be aimed at completing all the processes of the scientific method, from how to simply take a sample that is viable, to ensure that the number of samples is truly statistically acceptable, in order to be able to have information that is valuable for decision-making based on the results.</li> <li>• Recommended in-situ measurement equipment for use in coastal waters, including calibration and maintenance of this equipment.</li> <li>• Consideration should be given to the funding limitations that some countries have for properly carrying out sampling.</li> <li>• Expanding the laboratory analysis possibilities of human-related analyses with environmental analyses.</li> </ul>

	<ul style="list-style-type: none"> <li>• Due to under-staffing, interest in real-time monitoring of different water quality parameters.</li> <li>• Implementation of a quality control system in the laboratory.</li> </ul>
Pollution source management	<ul style="list-style-type: none"> <li>• Country specific pollution challenges (if possible) and best practice/management based on existing point and non-point sources acting as major environmental stressors.</li> <li>• Management of pollution sources to prevent the deterioration of ecosystems.</li> </ul>
Nutrient management	<ul style="list-style-type: none"> <li>• Nutrient management for the control of diffuse pollution.</li> </ul>
Partnerships and funding mobilization	<ul style="list-style-type: none"> <li>• Project management with funding sources such as GEF, European Union, among others.</li> </ul>
Water quality-biodiversity nexus	<ul style="list-style-type: none"> <li>• Effects of pollutants on marine and coastal fauna and flora.</li> <li>• It would be very interesting to know how the concentrations of nutrients and pathogenic organisms affect biodiversity.</li> </ul>
Wastewater management	<ul style="list-style-type: none"> <li>• Design and implementation of nature-based treatment systems</li> </ul>
Public awareness raising	<p>Community Engagement and Education:</p> <ul style="list-style-type: none"> <li>• Module 1: Public Awareness Campaigns – Designing and implementing effective public awareness campaigns.</li> <li>• Module 2: Community Involvement – Strategies for engaging local communities in water quality initiatives.</li> <li>• Module 3: Educational Programs – Developing educational materials and programs for schools and community groups.</li> </ul>
Disaster risk management	<ul style="list-style-type: none"> <li>• Design of early warning strategies for events such as algal blooms, substance spills, etc.</li> </ul>
Other: Remote sensing techniques	<ul style="list-style-type: none"> <li>• Use of GIS and remote sensing technology to gather data and develop modules and trends.</li> </ul>
Other: Integrated Water Resources Management (IWRM)	<p>Integrated Water Resources Management (IWRM):</p> <ul style="list-style-type: none"> <li>• Module 1: Principles of IWRM – Introduction to the principles and benefits of integrated water resources management.</li> <li>• Module 2: Case Studies – Analysis of successful IWRM projects in similar regions.</li> <li>• Module 3: Implementation Strategies – Practical steps for implementing IWRM in St. Kitts.</li> </ul>

5. Is there anything else you would like to share regarding needs to address capacity gaps and challenges in water quality monitoring and management, as well as pollution reduction and prevention in your country? (Open text response)

Given the opportunity to share anything else regarding needs to address capacity gaps and challenges in water quality monitoring and management, as well as pollution reduction and prevention in their country, respondents provided the following insights in an open text response:



### **Standardization and Harmonization**

- There is a strong need to harmonize data collection and reporting methods to ensure consistency within countries and across the WCR.
- Expanding and standardizing national monitoring programs is necessary to enhance water quality management.

### **Personnel and Resource Limitations**

- Many agencies struggle with financial, manpower, and equipment shortages.
- Continuous training, knowledge exchange, and scholarships for higher education are needed to strengthen institutional capacity.
- Capacity gaps are not always due to a lack of technical expertise but often stem from insufficient funding for equipment and resources.

### **Advanced Technologies and Emerging Contaminants**

- Expanding the use of satellite monitoring and cutting-edge equipment is key.
- Increased capacity is needed to assess and manage problems caused by contaminants of emerging concern (e.g., drugs, hormones, antibiotics).
- Advanced technology equipment is needed to implement new water quality analysis methodologies across different environmental matrices.

### **Stakeholder Engagement and Public Awareness**

- There is a need for agencies to share information and present to the public for them to make informed decisions in recreational water usage.
- Improved inter-institutional coordination and integration are needed.

### **Pollution Mitigation**

- While mitigation is important, it is considered somewhat secondary, though there is interest in full life-cycle approaches to water quality issues.
- Assessment and identification of water treatment plant needs (size, volume) in key locations is important to remediate untreated wastewater.
- A fundamental axis for plastic pollution is to promote the reduction of inputs with plastic, because it is the biggest pollution problem today.

6. Does your country have a coastal water quality monitoring program? (Choose one. If you select "No" or "I don't know", the survey will skip ahead to Section 8.)

It was found that 14 of the 19 surveyed countries (74%) have coastal water quality monitoring programs. Respondents that answered “yes” to this question continued to the following survey sections that addressed specific aspects of their monitoring programs, while those that responded “no” advanced directly to section 7.

## **Section 2: Coastal Water Quality Monitoring Design**

### *Summary*

The survey of the 14 countries with coastal water quality monitoring programs highlights the complexity of their implementation. Only three countries run their monitoring programs through one or two organizations, while the rest involve three to over ten entities. Many countries monitor beyond coastal surface waters, with 10 monitoring sub-surface depths, eight monitoring nearby freshwater, and seven monitoring groundwater.

Fewer countries analyze sediments or biota, with five and six monitoring sediments in coastal and freshwater areas, respectively, and five and four analyzing biota in these waters. Monitoring frequency remains a challenge; only two countries sample weekly, two sample monthly, and most adjust frequency based on location or available resources. Similarly, sediment and biota monitoring frequencies tend to vary by location and resource availability.

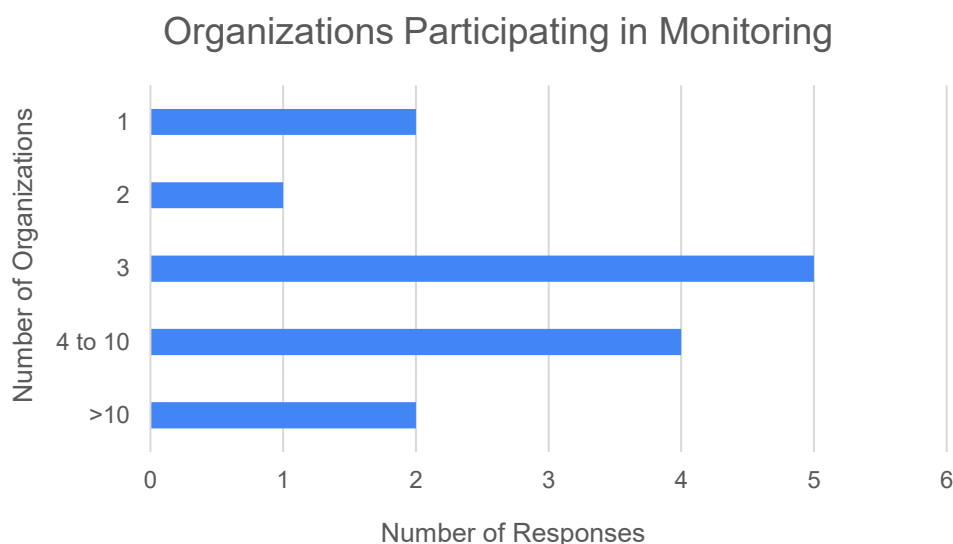
Most countries (12) have clearly identified the use of marine waters at their sampling sites, and while nine measure the same parameters at all sites, five adjust their analytical parameters based on water use. Similarly, eight apply consistent parameters in protected ecosystems, while five vary their analytical parameters depending on the protected ecosystem at each site

To improve the design of national coastal monitoring programs, 10-12 countries identified the need for capacity development in optimizing sampling frequency, positioning sites based on use, and selecting site-specific parameters based on the area's use or ecosystem.

### *Individual Questions*

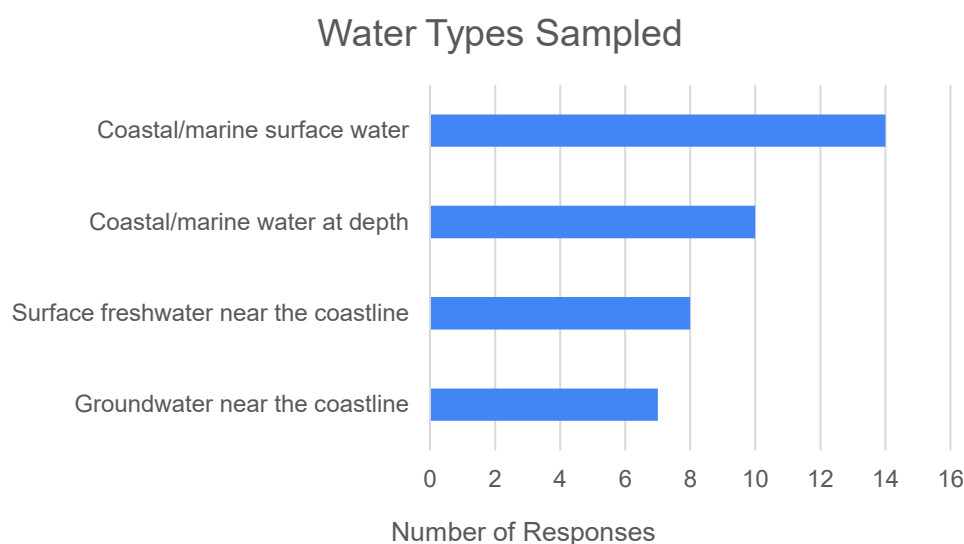
7. How many organizations participate in your country's coastal water quality monitoring program? (Choose one)

The complexity of running national coastal water quality monitoring programs was evidenced in the response to Q7 which showed that only three of the 14 surveyed countries that have coastal water quality monitoring programs run their programs through one or two organizations, while 3 organizations participate in the monitoring programs of five countries, 4-10 organizations participate in the programs of four countries, and more than 10 organizations participate in the monitoring of two countries.



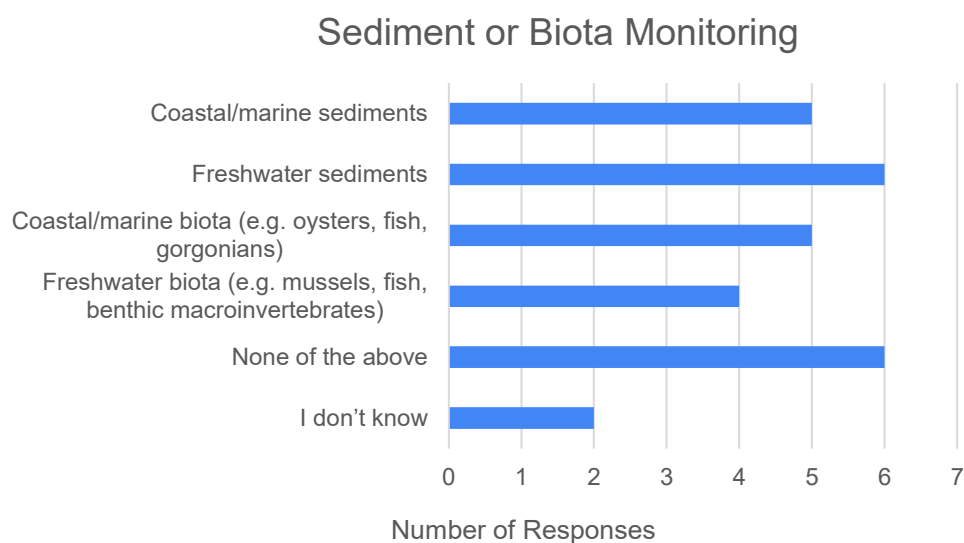
8. Which of the following water types are sampled as part of the coastal water quality monitoring program in your country? (Choose all that apply)

Responses to Q8 showed that many countries monitor more than just coastal surface waters, with 10 of 14 countries monitoring coastal waters at sub-surface depths, eight countries monitoring surface freshwater near the coastline, and seven countries monitoring groundwater near the coastline.



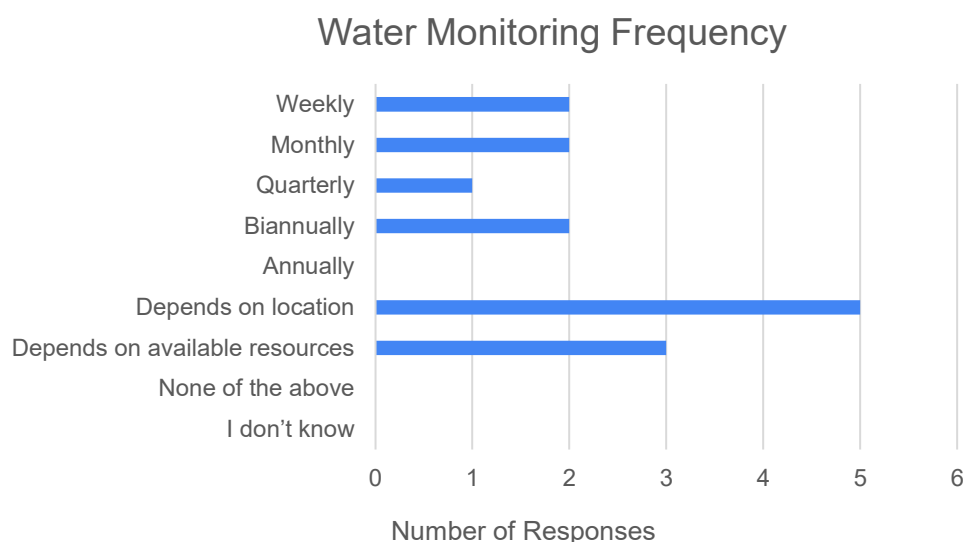
9. Does the coastal monitoring program in your country analyse contaminants in any of the following? (Choose all that apply)

As shown by the responses to Q9, fewer countries complement their water quality monitoring with analyses of sediment or biota. Five and six countries also monitor sediments in coastal waters and freshwater, respectively, while five and four countries include analyses of biota in coastal waters and freshwater, respectively.



10. At what frequency are **water quality samples** collected in your country? (Choose one)

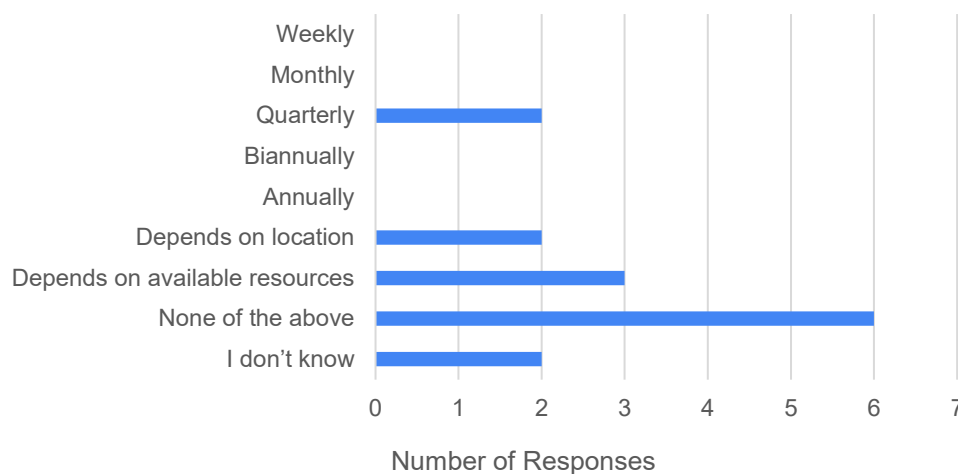
Responses to Q10 show that the frequency of water monitoring continues to be a challenge in the region with just two countries sampling weekly and another two sampling monthly. One country only monitors waters on a quarterly basis while two other countries monitor their waters biannually. Meanwhile, eight countries stated that their water monitoring frequency depends on locations or on available resources.



11. At what frequency are **sediment quality samples** collected in your country? (Choose one)

Q11 showed that two countries monitor sediments quarterly, while the other countries that monitor sediments apply a frequency that depends on location or available resources.

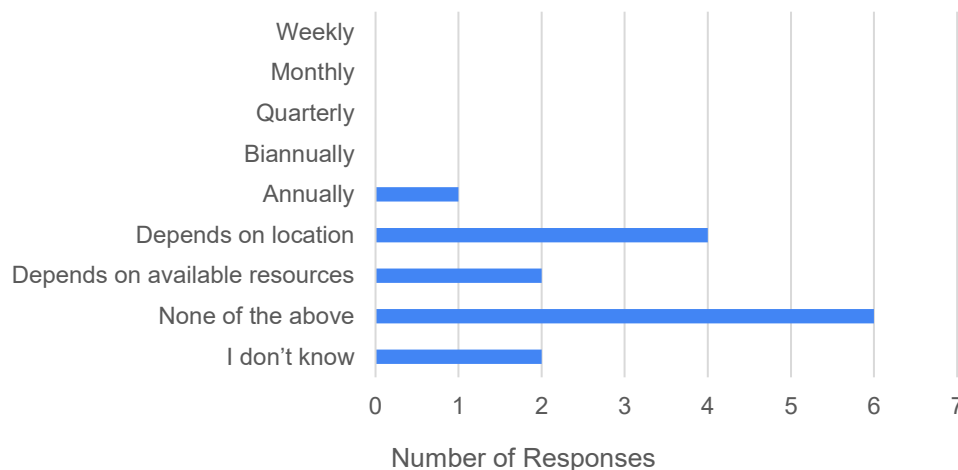
### Sediment Monitoring Frequency



12. At what frequency are **biota quality samples** collected in your country? (Choose one)

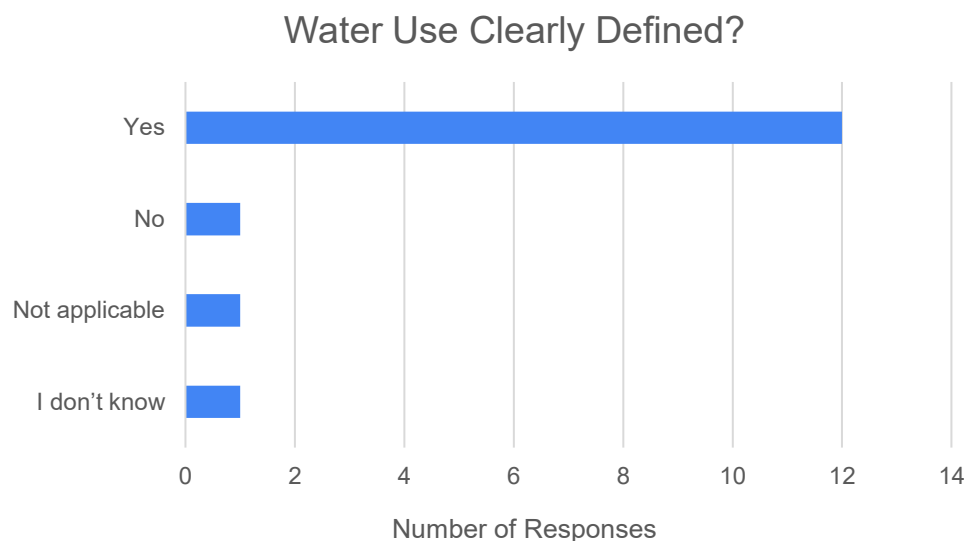
Q12 showed that one country monitors biota annually, while the other countries that monitor biota apply a frequency that depends on location or available resources.

### Biota Monitoring Frequency



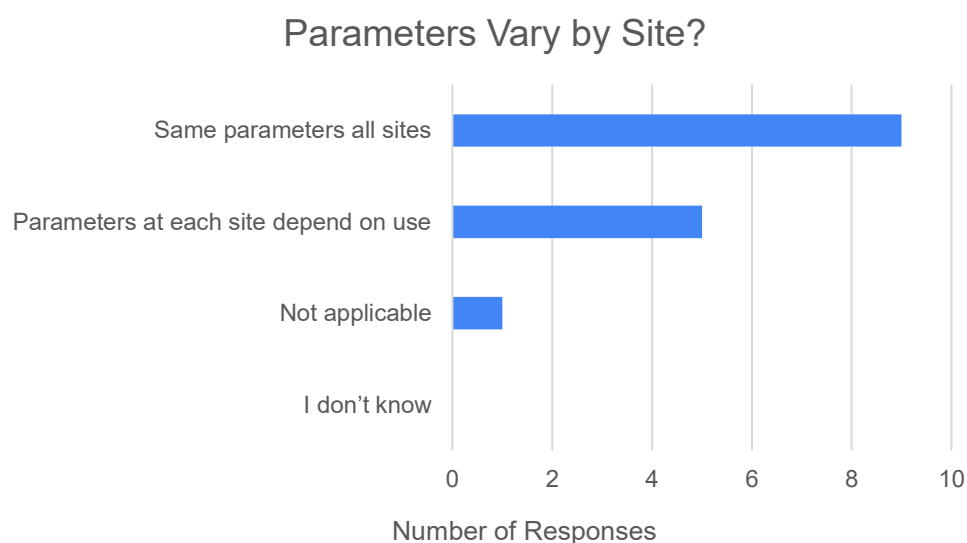
13. For each sampling site in your country's coastal water quality monitoring program, is the use of the area's marine waters clearly identified (e.g. beach, protected ecosystem, industrial, etc)? (Choose one)

Results to Q13 showed that most countries (12 of 14) have clearly identified the use of the area's marine waters (e.g. beach, protected ecosystem, industrial, etc.) for each sampling site in their country's coastal water quality monitoring program.



14. Which of the following best describes the design of your country's coastal water quality monitoring? (Choose one)

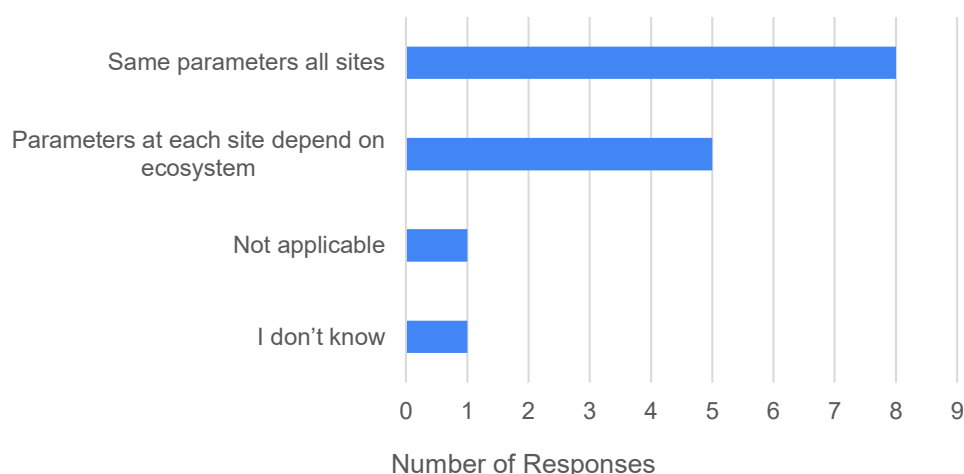
According to Q14, nine countries measure the same parameters at all sites while five countries vary their analytical parameters depending on the use of the marine waters at each site.



15. Which of the following best describes the design of your country's coastal water quality monitoring in areas where protected ecosystems are present? (Choose one)

Q15's results showed that eight countries measure the same parameters in all areas where protected ecosystems are present while five countries vary their analytical parameters depending on the protected ecosystem at each site.

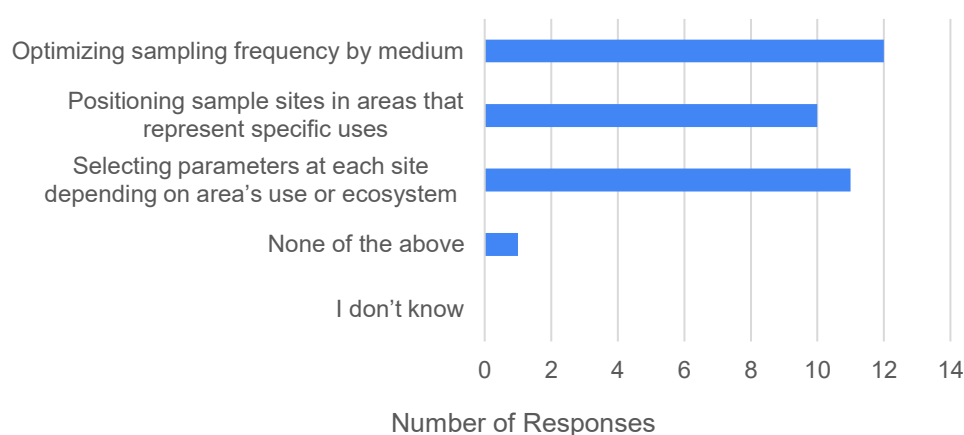
## Parameters Depend on Ecosystem?



16. In your opinion, which aspects of your country's coastal monitoring program design could benefit most from capacity development? (Choose all that apply)

With respect to improving the design of their national coastal monitoring programs, 10-12 countries stated they could benefit from capacity development to a) optimize their sampling frequencies based on the medium, b) position their sampling sites in areas that represent specific uses, and c) select parameters at each site depending on the area's use or ecosystem.

## Monitoring program design aspects that could benefit from capacity development



17. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges in the design of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- Additional personnel are required to support water quality sampling efforts. Collaborating with external stakeholders, such as universities and national parks, offers a potential way to expand sampling capacity.
- A key challenge is the degradation of access points over time or as a result of natural events, such as storms. This can render some sites inaccessible and lead to data gaps.
- It is also essential to identify emerging contaminants, including pharmaceuticals. However, limitations such as insufficient resources and the difficulty of installing monitoring stations in remote areas pose significant challenges.
- Enhanced resources and training would support research on the presence of contaminants in water bodies and facilitate knowledge exchange with other countries.
- Increased funding and support are also necessary to expand the number of sampling sites and improve sampling frequency throughout the year.
- Digitalizing data serves as a powerful tool for producing statistics, maps, and other outputs that support efficient decision-making in environmental management. Such tools help generate accurate, actionable information to guide control measures. While some countries have digital platforms for this purpose, many remain under development and are not yet operational.

### **Section 3: Water Quality Sampling**

#### *Summary*

All 14 surveyed countries follow a standardized written methodology for sample collection. All respondents sample surface waters, but only seven also collect samples below 2 meters. Most countries store sample site coordinates using GPS field units (11), nearby physical references (11), and databases (9). Nearly all (12) store protected ecosystem coordinates in maps, with many (9) also using databases. Slightly fewer countries store coastal human activity coordinates, with 10 using databases and nine using maps, often both.

Despite high levels of georeferencing, many countries seek capacity development in georeferencing coastal human activities (11), protected ecosystems (9), and sample sites (8). Eight respondents also expressed interest in training on standardized sampling methodologies. Additional capacity gaps include recording in situ observations during sampling, infrastructure for sample collection and passive samplers.

#### *Individual Questions*

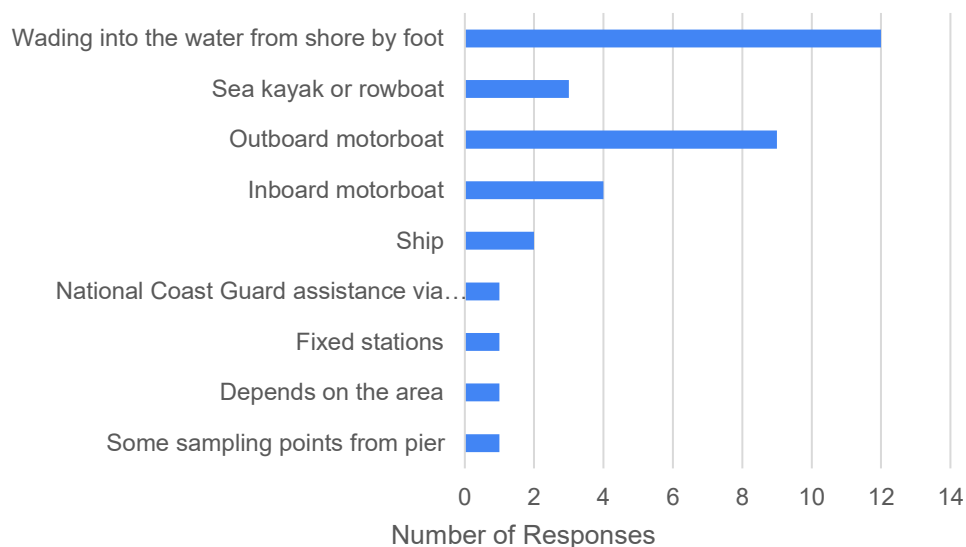
18. Which methods are used to collect samples for coastal water quality monitoring in your country? (Choose all that apply)

The most commonly used methods for collecting water samples are wading into the water from shore by foot and with an outboard motorboat. Fewer respondents utilize sea



kayaks, rowboats, inboard motorboats, ships, National Coast Guard assistance, fixed stations, or sampling off piers.

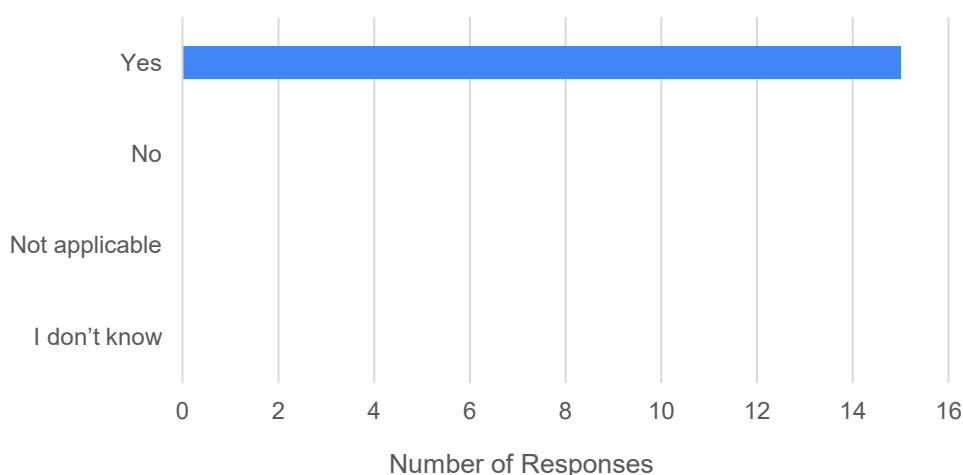
### Sampling Vehicles



19. Does your country's coastal water quality monitoring program use a standardized written methodology for the collection of samples (e.g. documented protocols, either internal or external)? (Choose one)

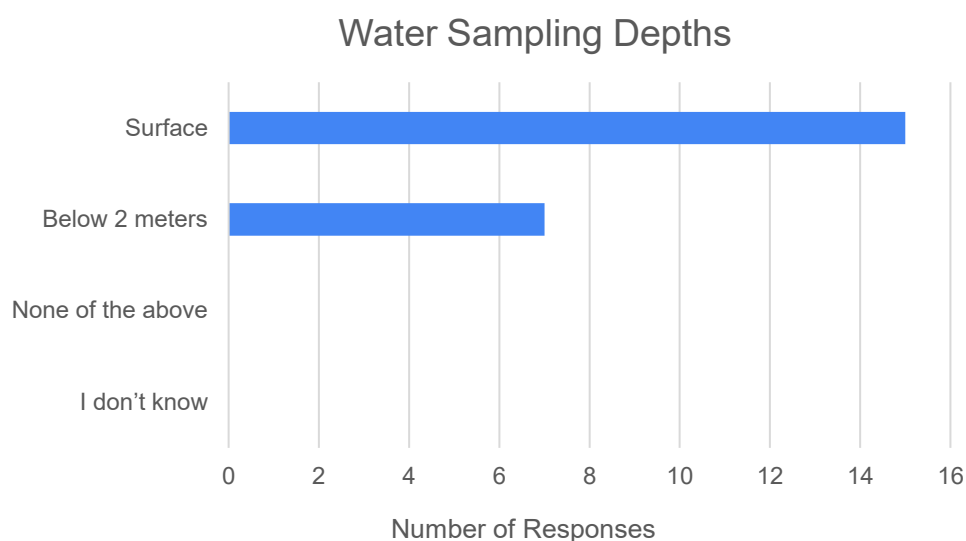
All respondents confirmed use of a standardized written methodology for the collection of samples.

### Standardized Sampling Methodology



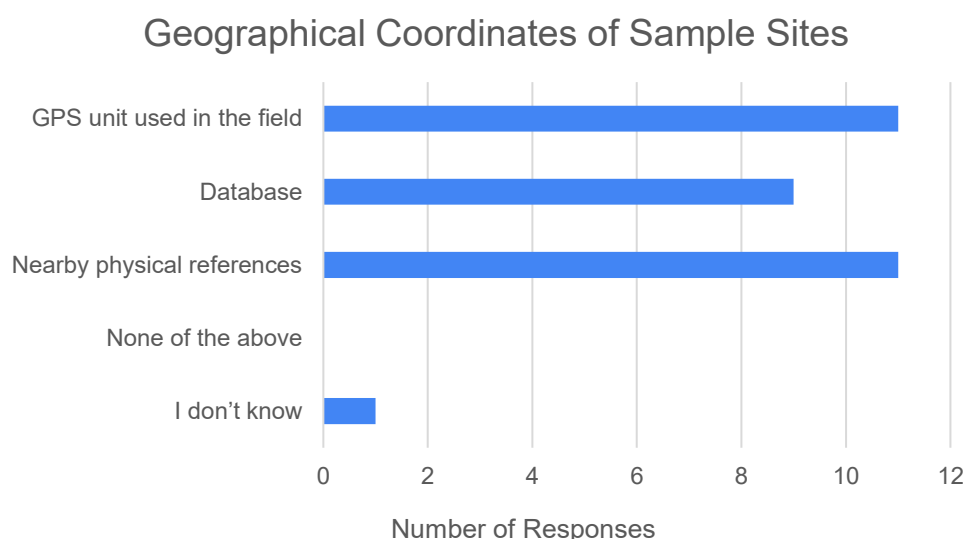
20. At what depths are water quality samples collected in the field as part of your country's coastal water quality monitoring program? (Choose all that apply)

While all 14 surveyed countries sample surface waters, only seven of them also take water samples below 2-meter depth. This response slightly contrasts with that of Q8 to which 10 respondents stated they take coastal water samples at sub-surface depths.



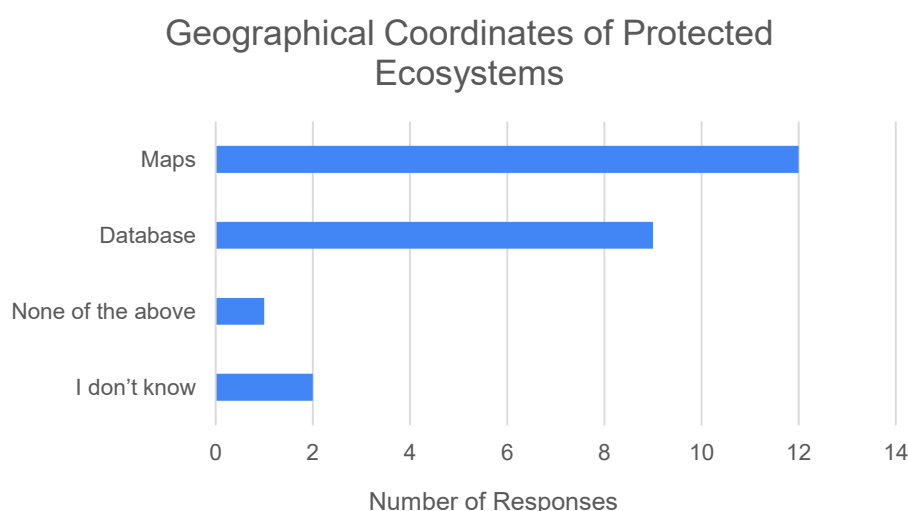
21. Are the geographical coordinates of the sample site locations in your country's coastal water quality monitoring program stored using any of the following methods? (Choose all that apply)

Most countries utilize GPS field units (11), nearby physical references (11) and databases (9) to store the geographical coordinates of their sample site locations. While some countries utilize just one of these methods, others utilize a combination of them.



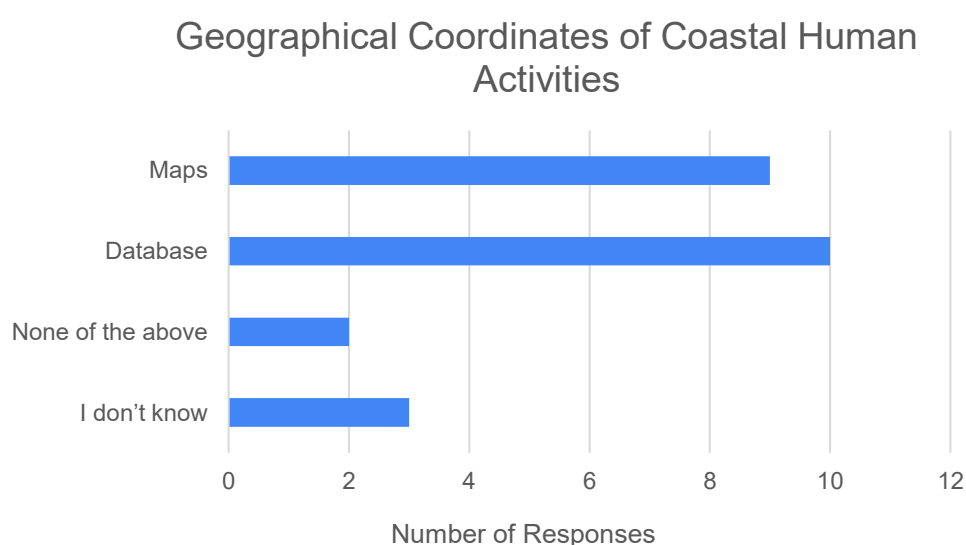
22. Are the geographical coordinates of protected ecosystems (e.g. coral reefs, mangroves, seagrasses) included in your country's coastal water quality monitoring program area stored using any of the following methods? (Choose all that apply)

Nearly all (12) of the surveyed countries store the geographical coordinates of protected ecosystems in maps, while many of them (9) also store them in databases. One respondent stated, “none of the above”, but as the question did not include an “other” option, it is not clear whether the country uses a different method for storing these coordinates or that they do not store them at all.



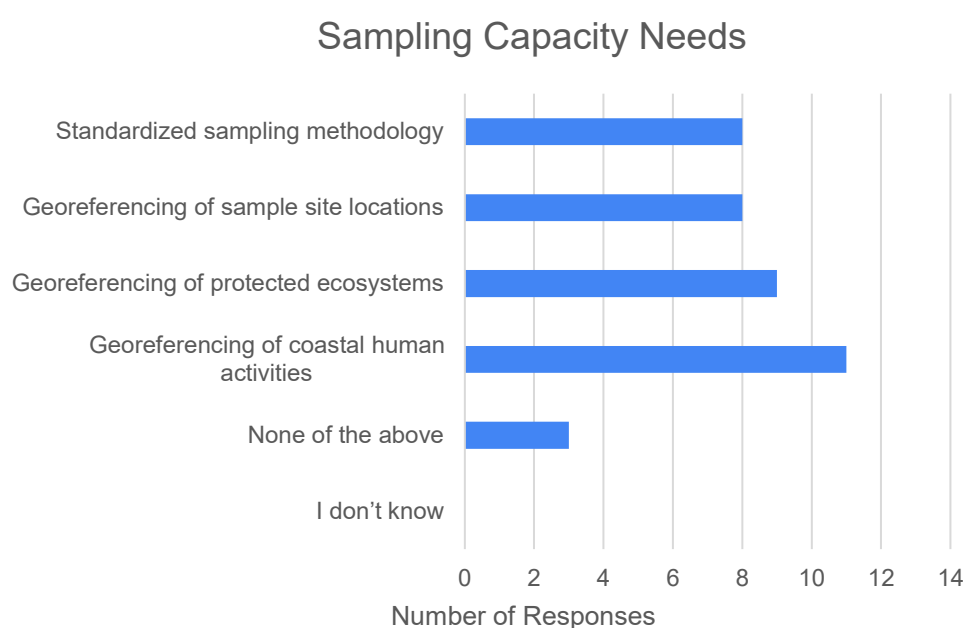
23. Are the geographical coordinates of coastal human activities (e.g. beaches, fishing areas, residential areas, industries, etc.) included in your country's coastal water quality monitoring program area stored using any of the following methods? (Choose all that apply)

A few less countries affirmed storing the geographical coordinates of coastal human activities compared to those that store the coordinates of protected ecosystems (Q22), with 10 countries utilizing databases and nine countries utilizing maps, and often both, to locate coastal human activities.



24. In your opinion, which aspects of sampling in your country's coastal monitoring program could benefit most from capacity development? (Choose all that apply)

Despite a relatively high rate of affirmative responses to the previous questions of this section, many countries still feel they would benefit from capacity development in georeferencing coastal human activities (11), protected ecosystems (9) and sample site locations (8). Eight respondents also signaled interest in capacity development in standardized sampling methodologies even though all 14 countries confirmed their use of a standardized written methodology for the collection of samples in Q19. As many countries already have these capacities in coastal water sampling, perhaps the expressed interest in capacity development in these aspects reflects the need to maintain personnel updated.



25. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges in the sampling of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- It is important to document specific activities or environmental conditions observed during sample collection, as these can provide valuable context for data interpretation.
- Establishing appropriate infrastructure to support sample collection, including the use of passive samplers, can enhance the effectiveness and consistency of monitoring efforts.
- A major challenge remains the limited financial and logistical capacity to carry out monitoring programmes. This includes costs related to transportation to sampling sites, boat rentals, and the maintenance or replacement of aging in-situ equipment.

- Engaging in regional collaboration to review and harmonize sampling and analytical methodologies with other countries could strengthen data comparability and quality.
- Additional funding is also needed to improve access to modern equipment, enabling more efficient in-situ or on-site analysis.

#### **Section 4: In Situ Analyses**

##### *Summary*

Many of the 14 surveyed countries use *in situ* sensors to measure pH (13), temperature (12), salinity (12), dissolved oxygen (11), and turbidity (11). While all respondents take surface water measurements, only five use these sensors below 2 meters.

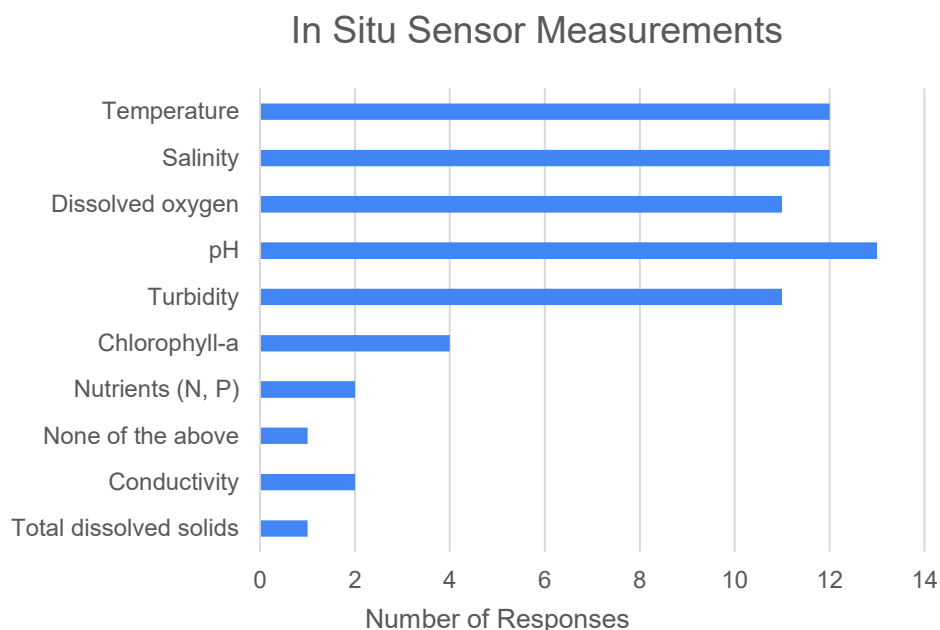
Field environmental observations are uncommon, with fewer than half recording sea transparency (7), cloud cover (6), air temperature (5), and wind speed (5). Only six countries measure river outlet discharge, a critical parameter for calculating pollution loads entering coastal waters. Even fewer (5) use oceanographic buoys, likely due to high costs, limiting real-time and long-term data collection.

Many countries seek capacity development in vertical profiling below the surface (11), use of *in situ* sensors (10), river discharge measurements (10), and environmental parameter monitoring (8). Additional gaps include using continuous measurement and remote monitoring devices, as well as ongoing training in handling sampling equipment.

##### *Individual Questions*

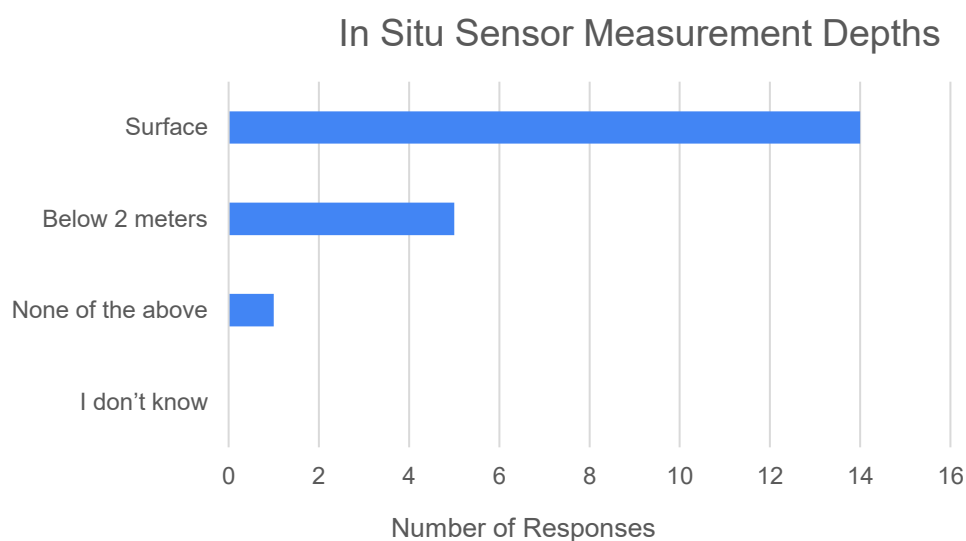
26. Does your country's coastal water quality monitoring program use *in situ* sensors to measure any of the following parameters in the field? (Choose all that apply)

Many of the 14 surveyed countries utilize *in situ* sensors to measure pH (13), temperature (12), salinity (12), dissolved oxygen (11) and turbidity (11), while far fewer utilize *in situ* sensors to measure chlorophyll-a (4), nutrients (2), conductivity (2) or total dissolved solids (1).



27. At what depths are *in situ* sensors used to measure water quality in the field as part of your country's coastal water quality monitoring program? (Choose all that apply)

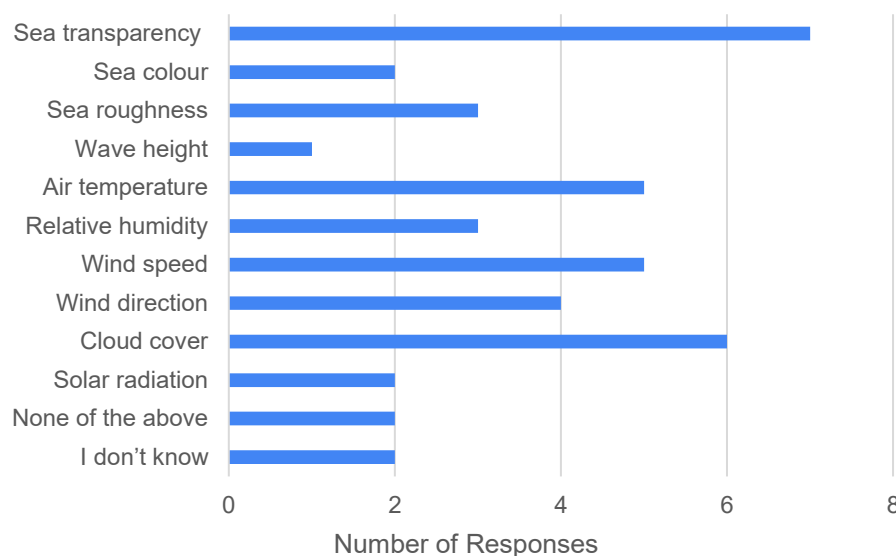
While all respondents utilize their *in situ* sensors to take measurements in surface waters, only five respondents use these sensors to take measurements at depths below 2 meters.



28. Which of the following environmental parameters are measured in the field, either precisely or approximately, as a part of your country's coastal water quality monitoring program? (Choose all that apply)

Environmental observations taken in the field are not common among the 14 surveyed countries with less than half recording sea transparency (7), cloud cover (6), air temperature (5), wind speed (5), wind direction (4), sea roughness (3), relative humidity (3), sea colour (2), solar radiation (2), and wave height (1).

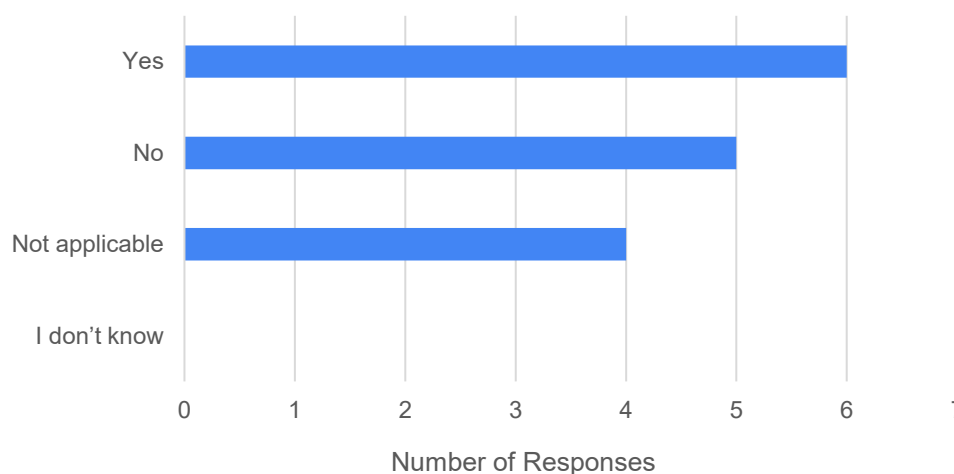
## Environmental Observations



29. Are river outlet discharges (i.e. flow in m<sup>3</sup>/s) measured in the field as part of your country's coastal water quality monitoring program? (Choose one)

Relatively few countries (6) take river outlet discharge measurements in the field as part of their country's coastal water quality monitoring program. This may be considered a significant deficiency considering the necessity of discharge values in calculating pollution loads entering coastal waters.

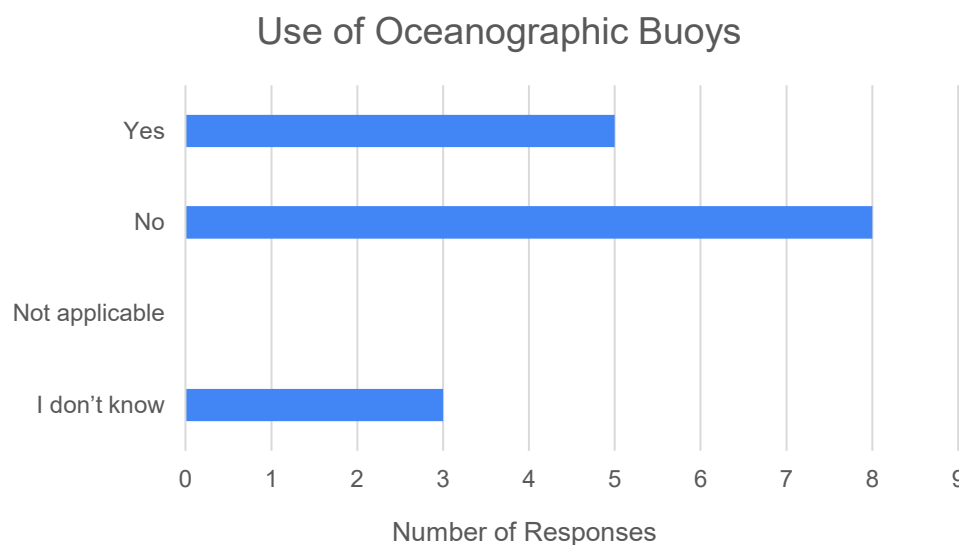
## River Outlet Discharge Measurements



30. Are oceanographic buoys used to measure *in situ* parameters in the field as part of your country's coastal water quality monitoring program? (Choose one)

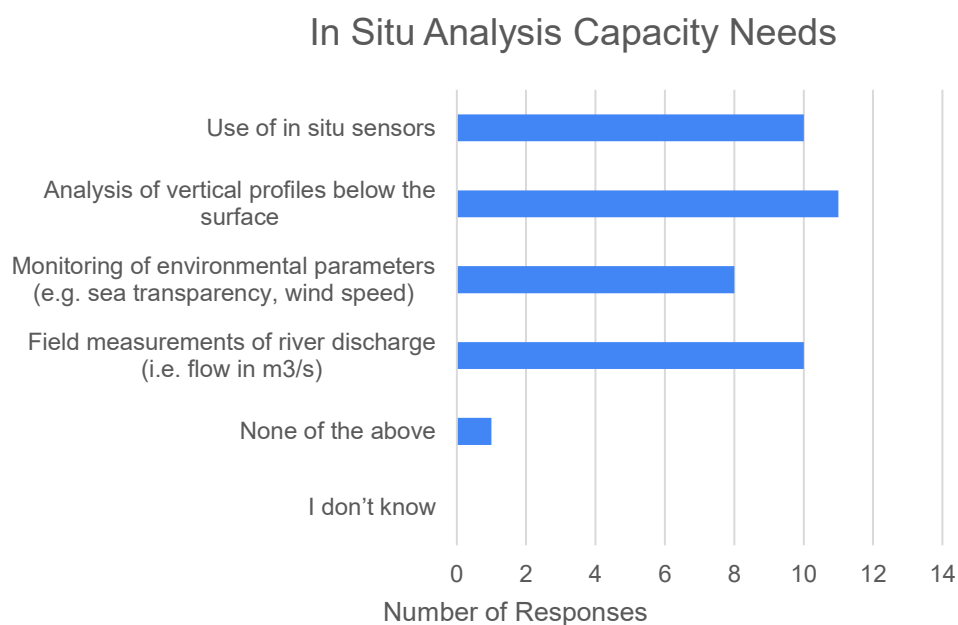
Even fewer countries (5) utilize oceanographic buoys to measure *in situ* parameters in the field. While this is unsurprising considering the high cost of acquiring and maintaining an

oceanographic buoy, this capacity gap results in limited real-time data and long-term time series data.



31. In your opinion, which aspects of *in situ* analyses in your country's coastal monitoring program could benefit most from capacity development? (Choose all that apply)

Many countries expressed interest in capacity development on aspects of *in situ* analyses including analysis of vertical profiles below the surface (11), use of *in situ* sensors (10), field measurements of river discharge (10), and monitoring of environmental parameters (8).





32. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges regarding the *in situ* analyses of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- The use of continuous measurement equipment can significantly enhance the quality and frequency of *in situ* data collection.
- There is a clear need to upgrade and modernize on-site analytical equipment to improve the reliability and efficiency of field measurements.
- Ongoing training on proper protocols for handling and operating sampling equipment is essential to ensure data quality and consistency.
- Expanding the use of remote monitoring technologies would strengthen long-term observation and coverage, particularly in hard-to-reach areas.
- Persistent funding constraints, along with challenges related to data standardization and harmonization, continue to hinder effective implementation and integration of *in situ* monitoring systems.

## **Section 5: Laboratory Analyses**

### *Summary*

All 14 surveyed countries conduct laboratory analyses of microbiological fecal pollutants, reflecting the region's priority on beach safety and wastewater risks. Nearly all countries analyze nutrients (13) and physical-chemical properties (12), while many also assess sediments (9). Fewer countries analyze metals (8), hydrocarbons (7), chlorophyll-a (6), microplastics (5), persistent organic pollutants (4), and pharmaceuticals (2).

Among the 13 countries analyzing nutrients, specific compounds vary: 10 analyze nitrate and total phosphorus, nine analyze total nitrogen, and eight analyze nitrite, ammonia, and phosphate. Only five analyze all six nutrient compounds. Notably, only eight countries report laboratory methodologies sensitive enough to detect the low concentrations typical of marine waters, raising concerns about data reliability and resource efficiency.

Most countries measuring microbiological fecal pollutants analyze fecal coliforms (13), with many also testing for total coliforms (11), enterococci (10), and *E. coli* (8). The emphasis on fecal coliforms aligns with traditional recommendations for swimming waters, while fewer countries analyze enterococci, a more recent and preferred indicator of gastrointestinal illness risk.

Nearly all laboratories follow standardized methodologies, quality assurance (QA), and test method quality control (QC) procedures. Most (11) are certified, either generally or for specific parameters, and nearly all (12) are also equipped to analyze domestic and industrial wastewater samples.

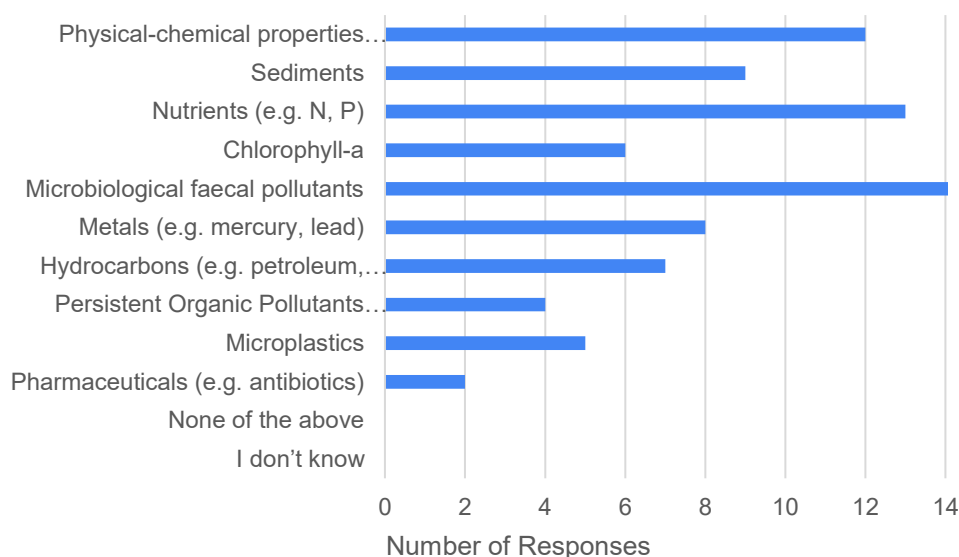
Countries expressed interest in strengthening laboratory capacities, particularly in processing sediment and biota samples (12), current methods for water analyses (11), and QA/QC procedures (9). The highest-priority analyses for capacity development include persistent organic pollutants (12), microplastics (11), and pharmaceuticals (9).

### Individual Questions

33. Which of the following types of parameters are analysed in laboratories as part of your country's coastal monitoring program? These could be analysed either routinely or occasionally, and could include analyses in water, sediments or biota. (Choose all that apply)

All 14 surveyed countries conduct laboratory analyses of microbiological faecal pollutants, reflecting the region's priority in protecting its beaches for recreational use and the potential risks of untreated wastewater. Nearly all countries measure nutrients (13) and physical-chemical properties (12), and many also analyze sediments (9). Only about half of countries analyze metals (8), hydrocarbons (7) and chlorophyll-a (6), while fewer analyze microplastics (5), persistent organic pollutants (4) and pharmaceuticals (2).

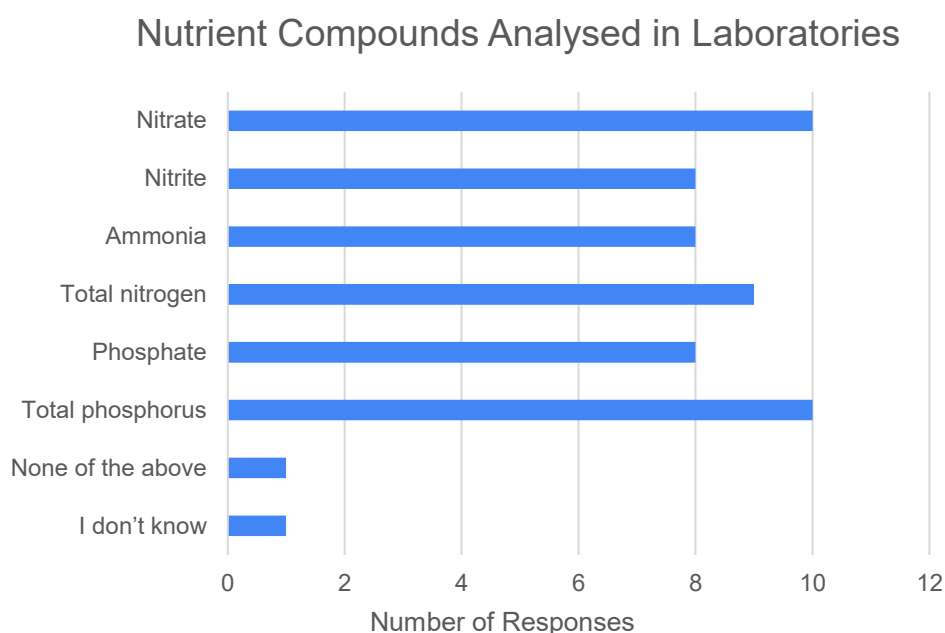
### Parameters Analysed in Laboratories



34. Which of the following nutrient compounds are analysed in laboratories as part of your country's coastal water quality monitoring program? (Choose all that apply)

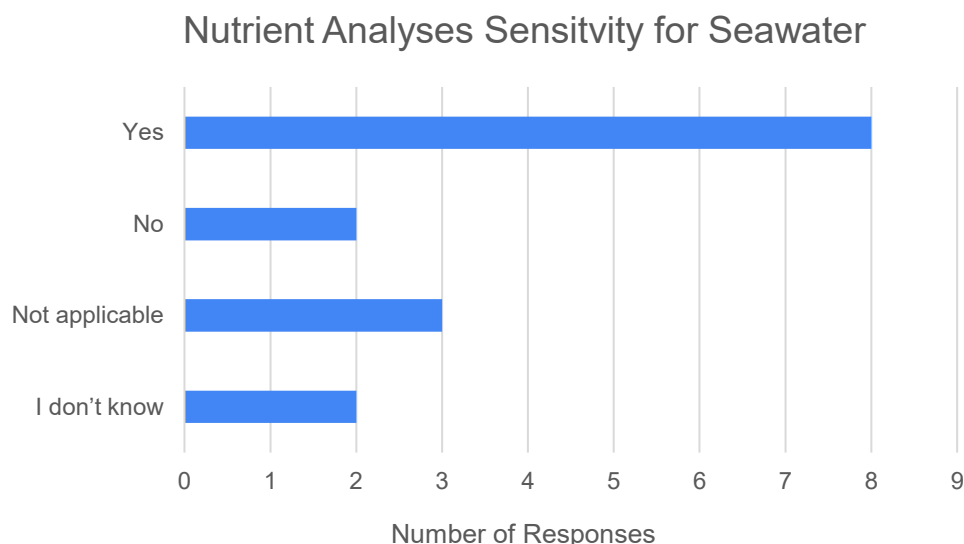
Of the 13 countries that analyze nutrients, the specific nutrient compounds vary widely with 10 analyzing nitrate and total phosphorus, nine analyzing total nitrogen, and eight analyzing nitrite, ammonia, and phosphate. Five of these countries analyze all six of the

mentioned nutrient compounds (nitrate, nitrite, ammonia, total nitrogen, phosphate and total phosphorus) while the rest analyze some combination of these but not all.



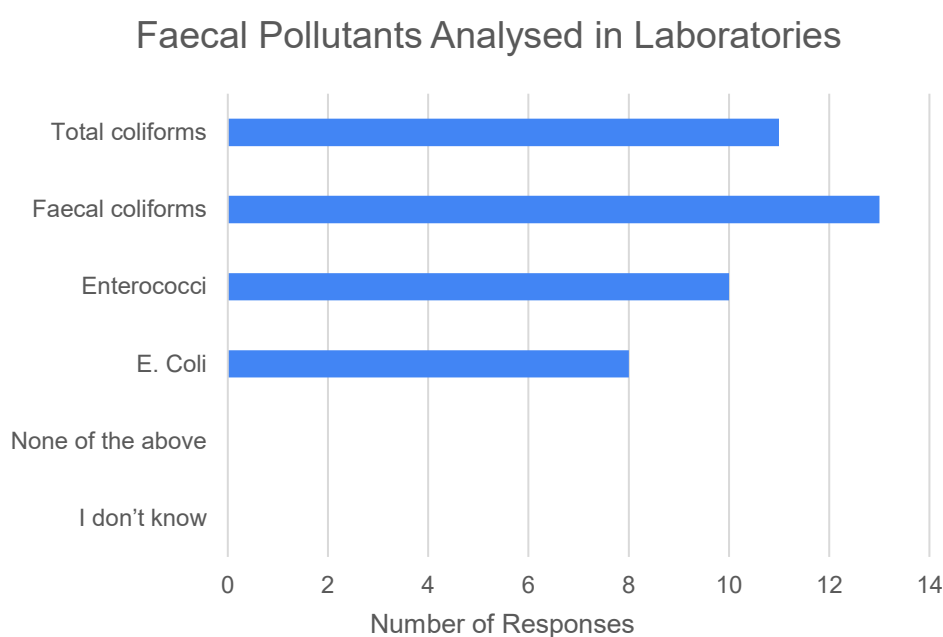
35. Are the methodologies for nutrient analysis in your country's coastal water quality monitoring program sensitive enough to detect the low concentrations typical of marine waters (i.e. micrograms per litre,  $\mu\text{g/l}$ )? (Choose one)

Surprisingly, only 8 of the 13 countries that measure nutrients in their laboratories affirmed that their methodologies are sensitive enough to detect the low concentrations typical of marine waters (i.e. micrograms per litre,  $\mu\text{g/l}$ ). This represents a significant deficiency for the laboratories that lack this capacity as their efforts in analyzing nutrients would be limited to freshwater outflows. Any analyses of nutrients in marine waters that these laboratories attempt would likely yield results below detection limits, which are essentially irrelevant and an inadequate use of resources.



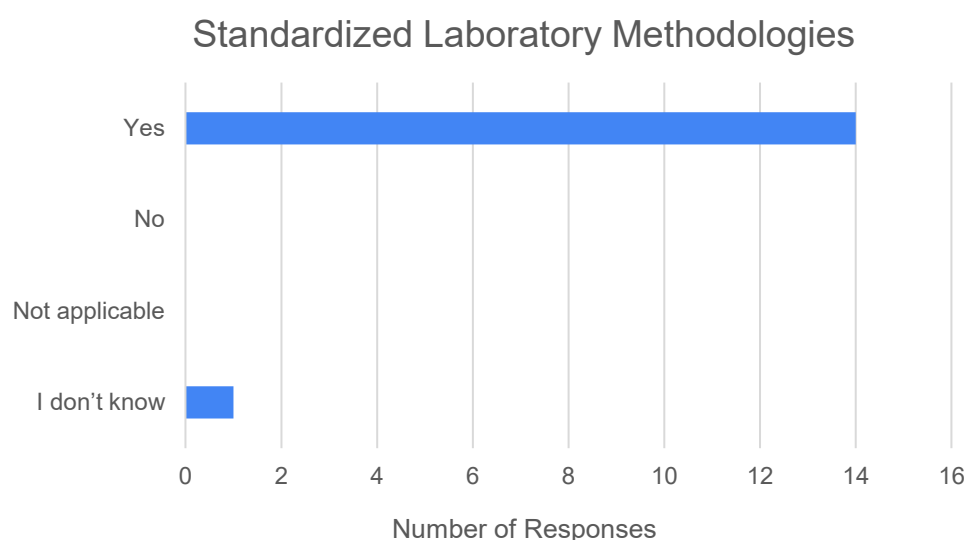
36. Which of the following types of microbiological faecal pollutants are analysed in laboratories as part of your country's coastal water quality monitoring program? (Choose all that apply)

Of the 14 countries that affirmed in Q33 that they conduct laboratory analyses of microbiological faecal pollutants, nearly all of them (13) analyze the faecal coliforms parameter. Many countries also analyze total coliforms (11), enterococci (10) and E. Coli (8). The tendency towards measuring faecal coliforms is unsurprising as it has traditionally been the parameter recommended for analysis in swimming waters. More recent research has identified enterococci as a better indicator of risk of gastrointestinal illness resulting from water contamination in recreational coastal waters, and so the fact that less countries analyze enterococci is unsurprising as the capacity for these analyses has had less time to develop.



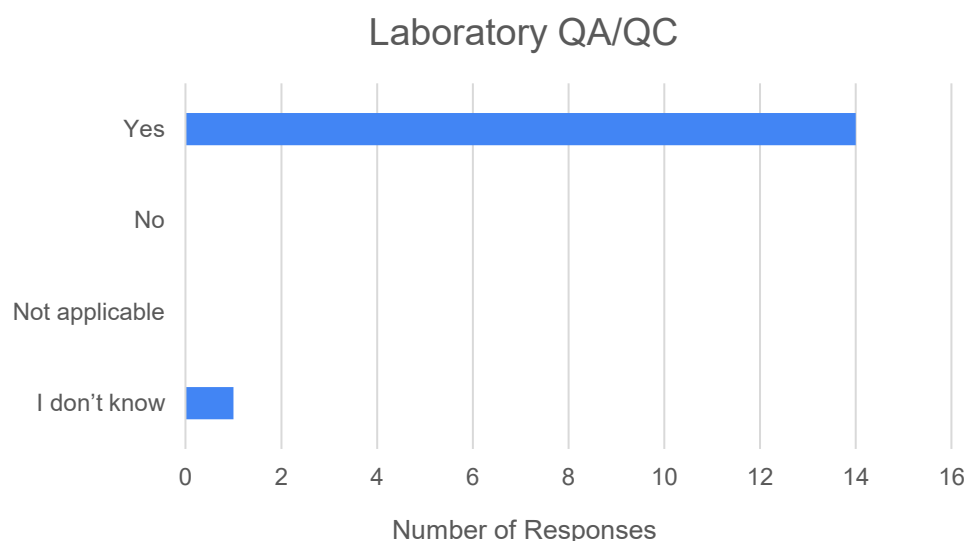
37. Do the laboratories forming part of your country's coastal water quality monitoring program use standardized written methodologies for their analyses (e.g. documented protocols, either internal or external)? (Choose one)

Nearly all of the laboratories forming part of the surveyed countries' coastal water quality monitoring program use standardized written methodologies for their analyses.



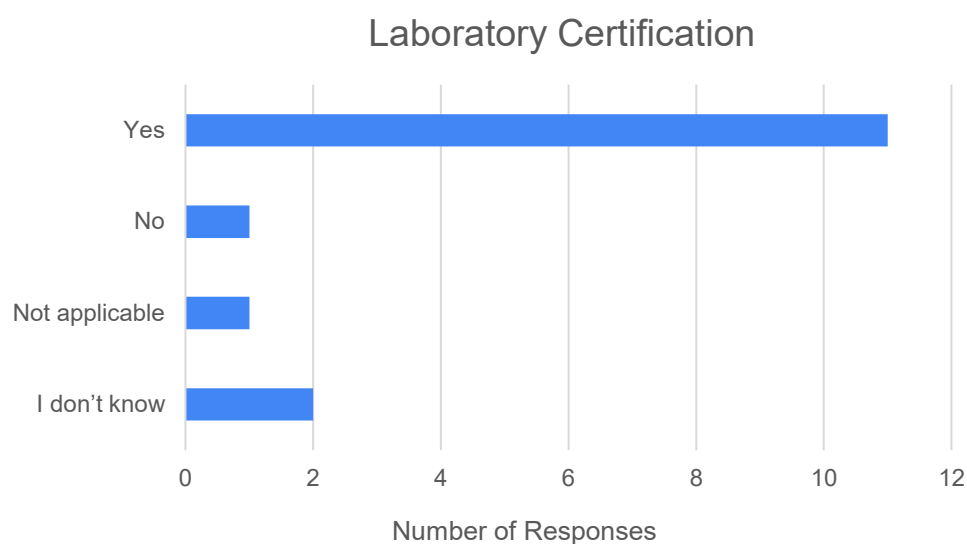
38. Do the laboratories forming part of your country's coastal water quality monitoring program use standardized methods of quality assurance (QA) and test method quality control (QC) to ensure the validity of data (e.g. ISO 17025)? (Choose one)

Nearly all of the laboratories forming part of the surveyed countries' coastal water quality monitoring program use standardized methods of quality assurance (QA) and test method quality control (QC) to ensure the validity of data.



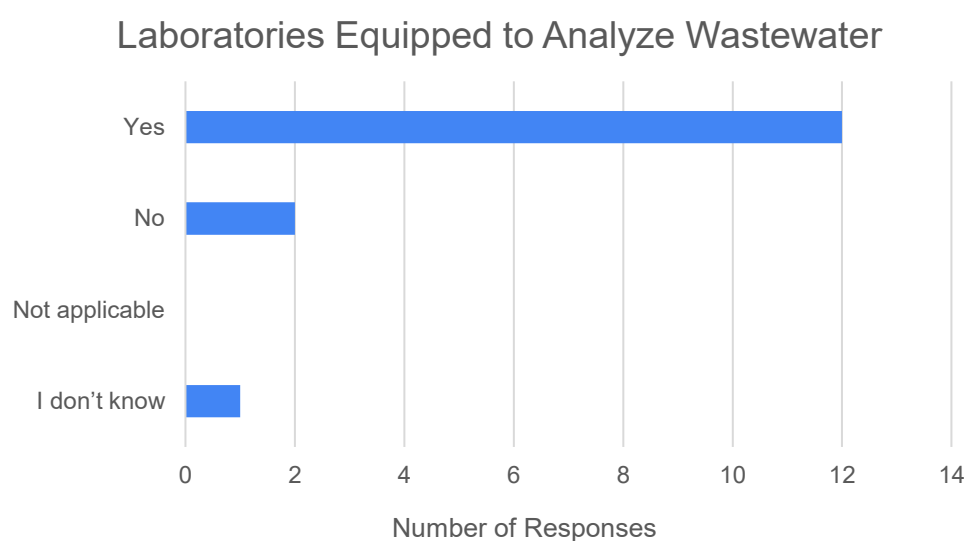
39. Do the laboratories forming part of your country's coastal water quality monitoring program undergo a process of certification, either for the laboratory in general or for the analysis of specific parameters? (Choose one)

Most of the laboratories (11) forming part of the surveyed countries' coastal water quality monitoring program undergo a process of certification, either for the laboratory in general or for the analysis of specific parameters.



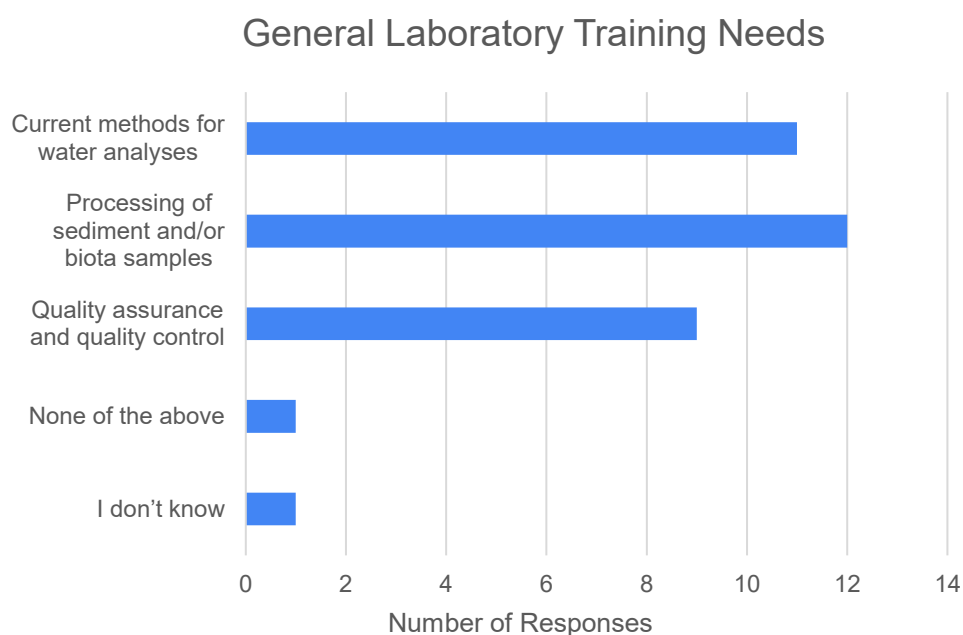
40. Are the laboratories used as part of your country's coastal water quality monitoring also equipped to analyse the water quality of domestic or industrial wastewater samples? (Choose one)

Most of the laboratories (12) forming part of the surveyed countries' coastal water quality monitoring program are also equipped to analyse the water quality of domestic or industrial wastewater samples.



41. In your opinion, which aspects could laboratories forming part of your country's coastal monitoring program benefit most from capacity development? (Choose all that apply)

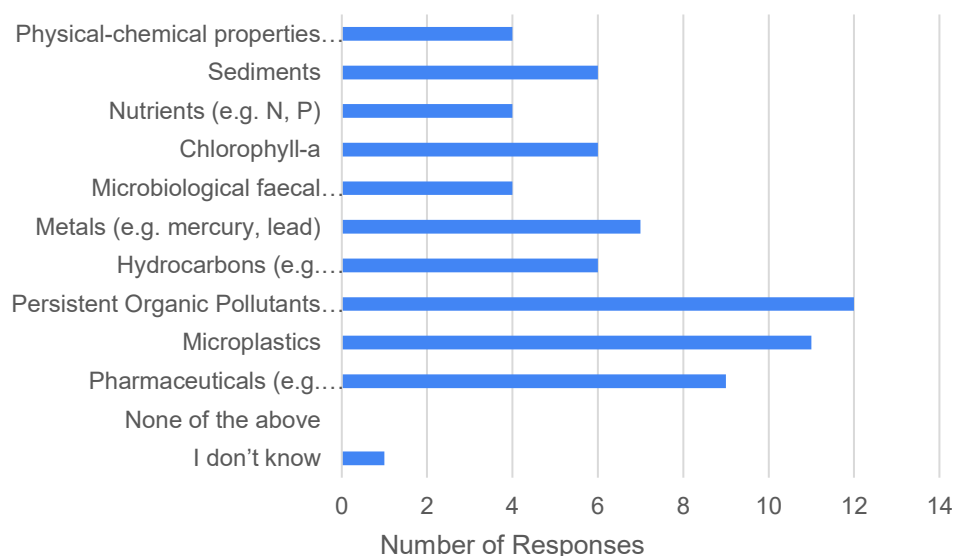
Respondents expressed interest in capacity development for the laboratories forming part of their national coastal monitoring program, specifically in the processing of sediment and/or biota samples (12), current methods for water analyses (11), and quality assurance and quality control (9).



42. Which types of laboratory analyses could most benefit from capacity development for your country's coastal water quality monitoring program? (Choose all that apply)

The specific laboratory analyses of most interest for capacity development were identified as persistent organic pollutants (12), microplastics (11) and pharmaceuticals (9). Other parameters of interest include metals (7), sediments (6), chlorophyll-a (6), hydrocarbons (6), physical-chemical properties (4), nutrients (4) and microbiological faecal pollutants (4).

## Laboratory Specific Analysis Training Needs



43. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges in laboratory analyses of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- Laboratories that lack standardized methods or ISO accreditations would therefore greatly benefit from capacity development.
- Challenges include those related to novel methods and indicators as well as the acquisition/replacement of advanced equipment for the determination of "typical" or "historical" indicators.
- Capacity development in the implementation of microplastics analysis methodologies would be beneficial
- High lab costs remain a challenge.



## **Section 6: Data Management and Data Analysis**

### *Summary*

Centralized digital databases are used by 10 of 14 surveyed countries for storing coastal water quality data, though the absence of such systems in four countries highlights an important capacity gap due to the risks of data loss and restricted accessibility. Similarly, 10 countries use standardized data formats, ensuring compatibility and integration, while the remaining four likely face challenges in data sharing.

The use of weighted indices (e.g., Water Quality Index) is evenly split, with seven countries employing them and seven not. Statistical analyses are relatively uncommon, with seven countries using regressions, six using correlations, and five applying ANOVA. Nearly all (11) use GIS for mapping results, but only five use it for spatial interpolations.

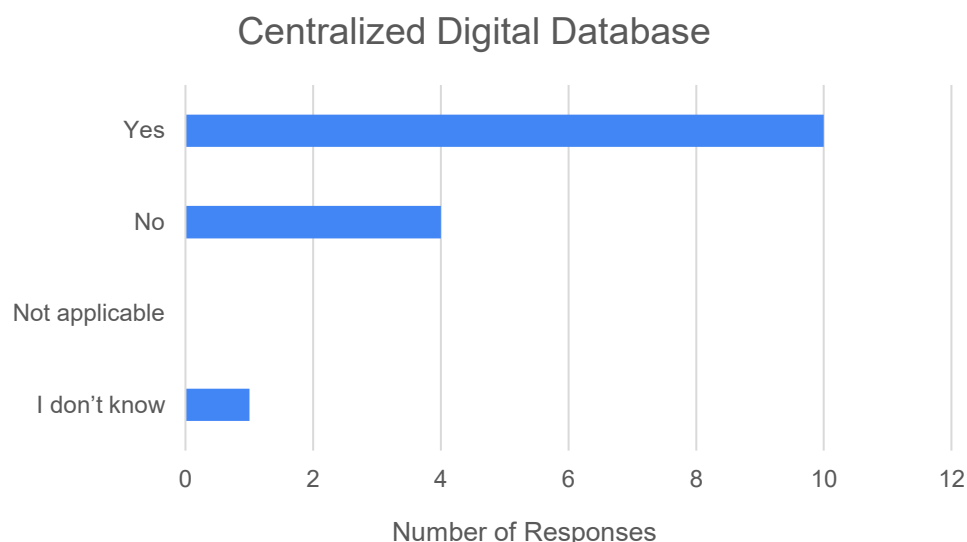
All 14 countries expressed interest in capacity development in advanced statistical analyses. Other priority areas include weighted indices (11), centralized database configuration and maintenance (10), standardized result formatting (9), and GIS applications (8).

Additional capacity gaps include outdated databases, challenges in database configuration and sustainability, and the need to digitize old databases for long-term assessments.

### *Individual Questions*

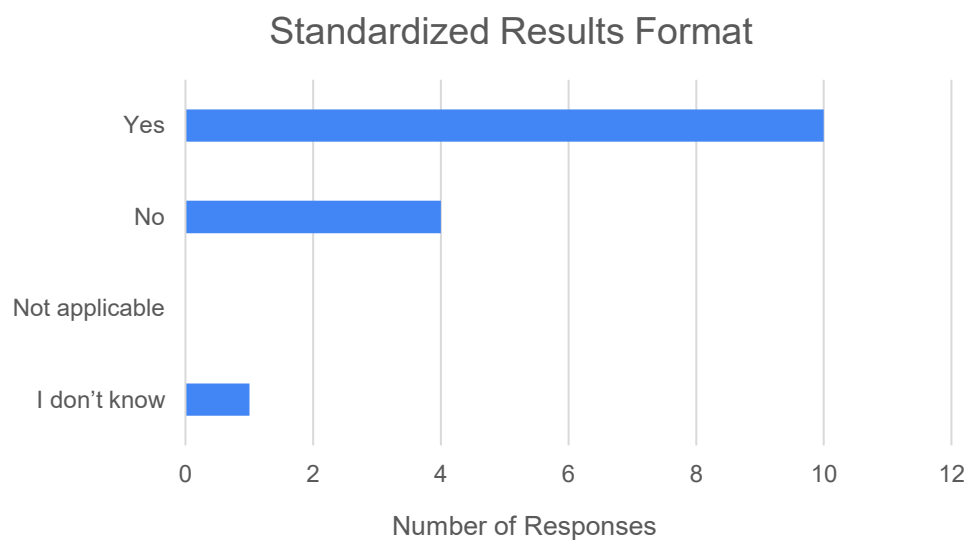
44. Does your country's coastal water quality monitoring program have a centralized digital database for storing all its results? (Choose one)

Centralized digital databases are common for storing the results of coastal water quality monitoring program with 10 of 14 countries confirming their use. However, these results highlight an important capacity gap for the countries that do not use centralized digital databases as this represents a risk of data loss and limitations in data accessibility.



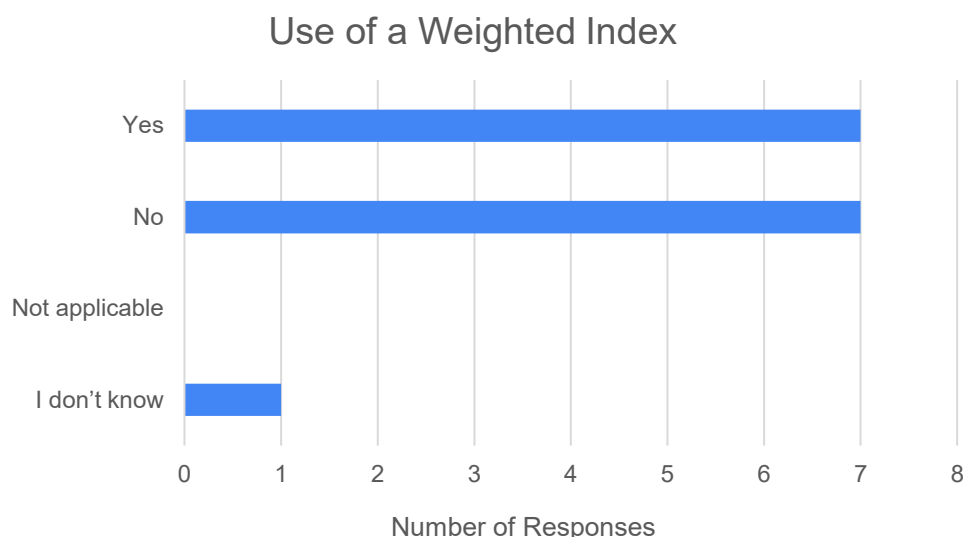
45. Does your country's coastal water quality monitoring program use a standardized format (e.g. templates or protocols) to store all its results? (Choose one)

The use of standardized formats for data storage by 10 of the 14 surveyed countries represents a positive result for these 10 countries, while highlighting a significant capacity gap for the countries that do not use such formats as this can result in data incompatibility and limitations in data sharing and integration.



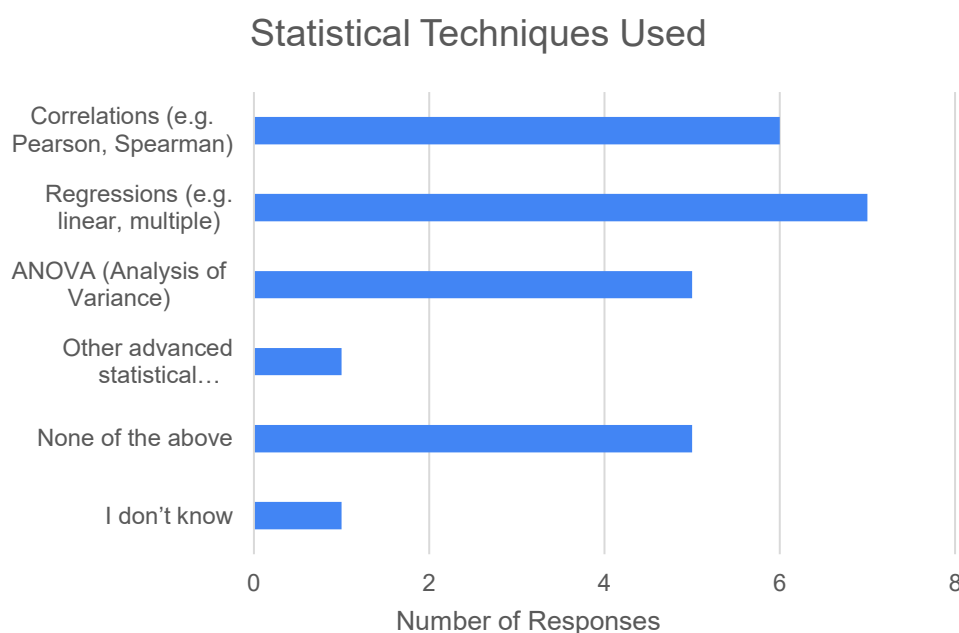
46. Does your country's coastal water quality monitoring program use some sort of weighted index (e.g. Water Quality Index, WQI) to summarize results into a single "score" or "rating"? (Choose one)

An even split was observed in the results regarding the use some sort of weighted index (e.g. Water Quality Index, WQI) to summarize results into a single "score" or "rating", with 7 countries responding "yes" and 7 responding "no".



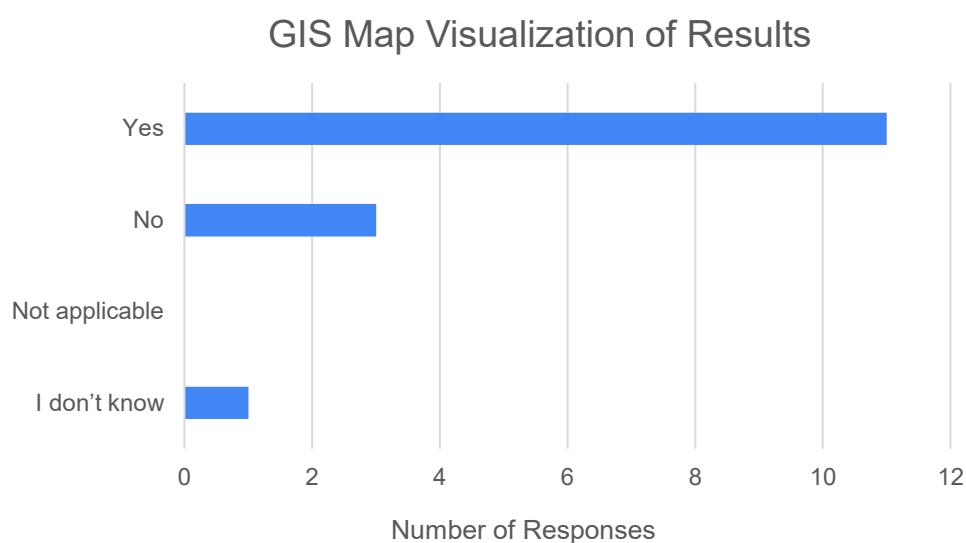
47. Are any of the following statistical techniques used in your country's coastal water quality monitoring program to analyse trends or patterns in the data? (Choose all that apply)

The use of statistical techniques to analyse data trends or patterns is relatively uncommon with only seven countries applying statistical regressions, six using correlations, and five applying ANOVA.



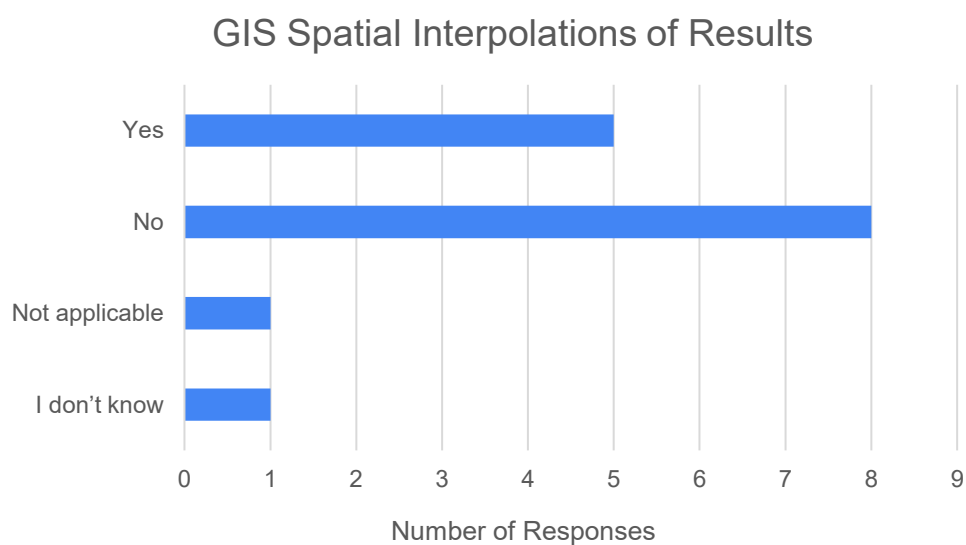
48. Are Geographical Information Systems (GIS) used to create maps that visually display the results of your country's coastal water quality monitoring program? (Choose one)

Nearly all countries (11) utilize Geographical Information Systems (GIS) to create maps that visually display their results.



49. Are Geographical Information Systems (GIS) used to conduct spatial interpolations (e.g. predicting values between sampled points) for your country's coastal water quality monitoring program? (Choose one)

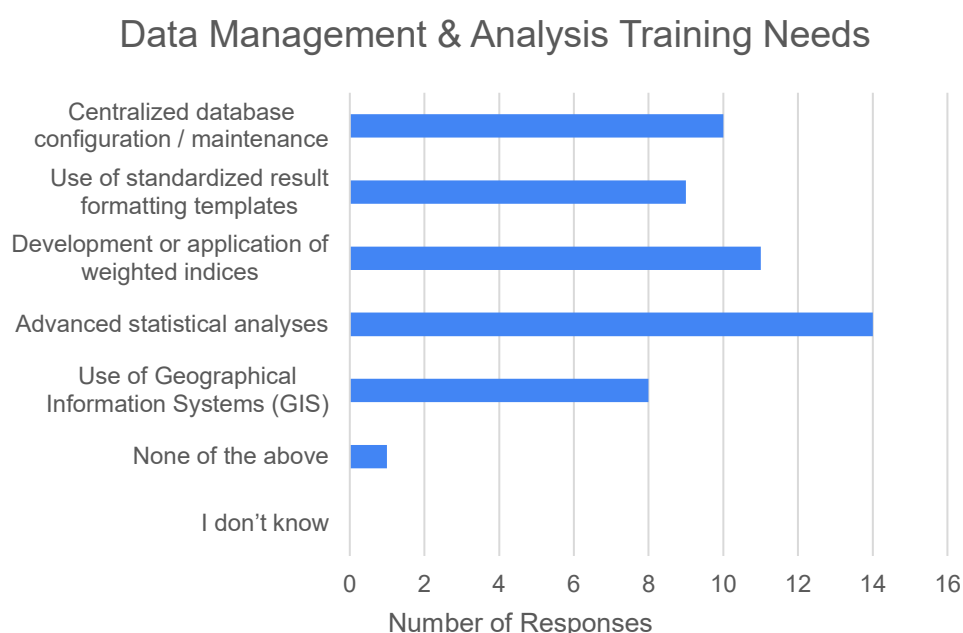
Few countries (5) utilize Geographical Information Systems (GIS) to conduct spatial interpolations of their results.



50. In your opinion, which aspects of database management and data analysis in your country's coastal monitoring program could benefit most from capacity development? (Choose all that apply)

All 14 surveyed countries expressed interest in capacity development in advanced statistical analyses. Other topics of interest for capacity development included development or application of weighted indices (11), centralized database configuration

/ maintenance (10), use of standardized result formatting templates (9), and use of Geographical Information Systems (8).



51. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges in database management and data analysis of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- The platforms for some national environmental quality databases have become obsolete in the face of new statistical information analysis technologies.
- Challenges include the configuration and maintenance of databases. Once the databases are configured and established, the sustainability of the database and information systems is the main challenge. On the other hand, the digitalization of old databases is also another challenge, but it is essential for long-term evaluations.
- Implementation of statistical tools in data analysis remains a capacity gap.

## **Section 7: Reporting of Results**

### *Summary*

Responses indicate that the frequency of reporting to external organizations or stakeholders is often minimal, with six countries reporting annually, three quarterly, and one monthly, while some may not report at all.

Most countries (10) share results via technical reports, while fewer (5) use online bulletins, dashboards, or interactive maps, and only one incorporates physical bulletin boards. Reporting is primarily directed to government authorities (10), with some also making results publicly accessible online (7), sending them to non-government stakeholders (6), or sharing them with the media (4).

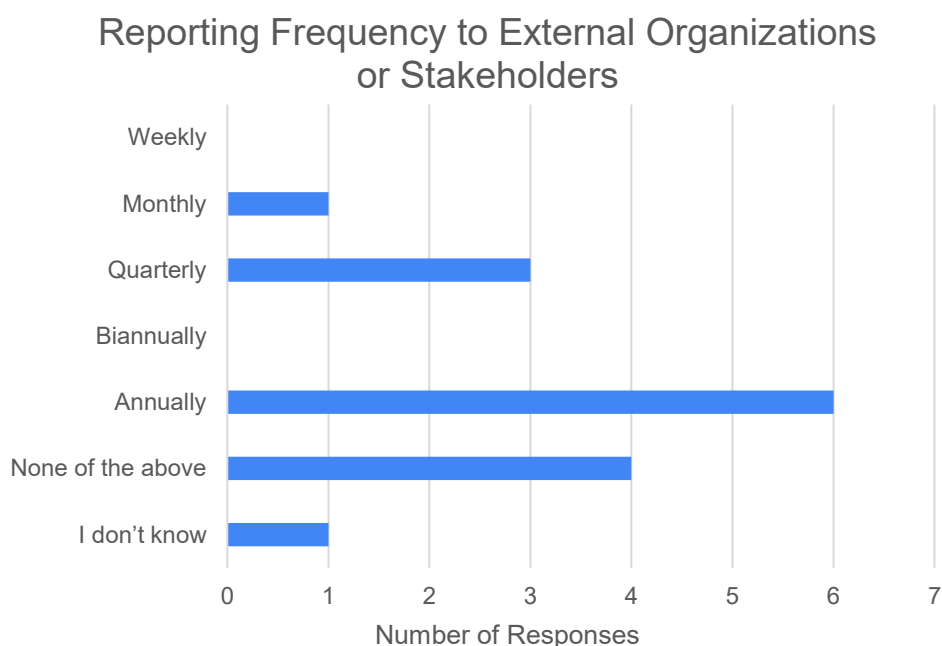
Half of respondents (7) use standardized reporting templates or protocols. A majority express interest in capacity development to diversify their reporting channels (12), improve their reporting mechanisms (11), and adopt standardized formatting (9).

Additional capacity gaps include the need to establish a national central repository with trained analysts, tailoring reporting formats to different audiences, and reviewing the standardization of data reporting documents.

### *Individual Questions*

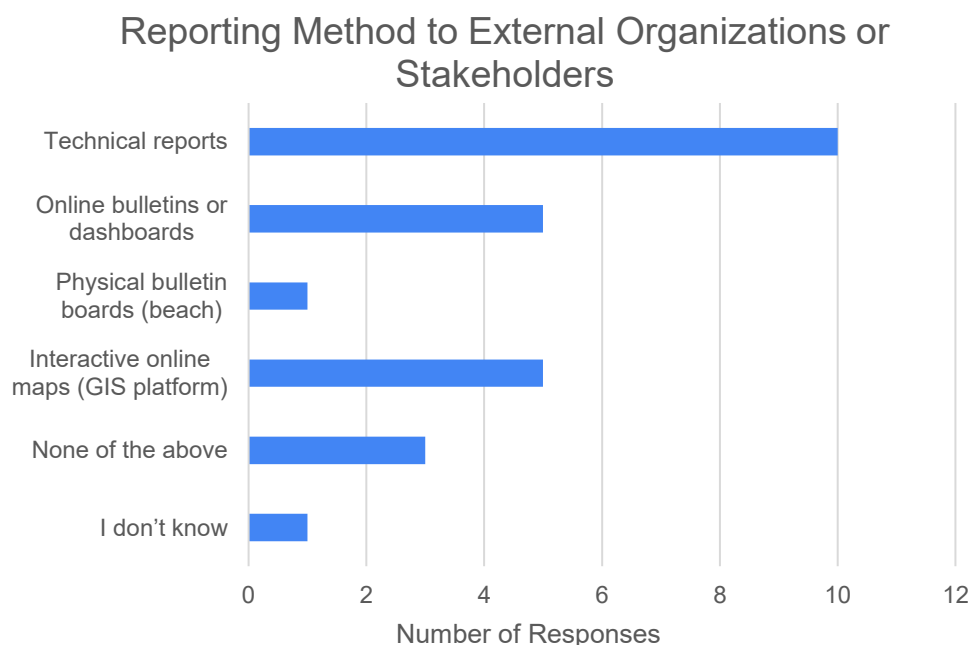
52. At what frequency are the results of your country's coastal water quality monitoring program reported to external organizations or stakeholders? (Choose one)

Responses evidence an inopportune frequency of reporting results to external organizations or stakeholders, with six countries reporting annually while three report quarterly and one reports monthly. One country stated that their reporting frequency depends on the sampling frequency of different components of their monitoring program, with reporting ranging from every few minutes to annually. Some countries responded "none of the above" which may imply they do not report at all to external organizations or stakeholders.



53. Through which of the following methods are the results of your country's coastal water quality monitoring program reported to external organizations or stakeholders? (Choose all that apply)

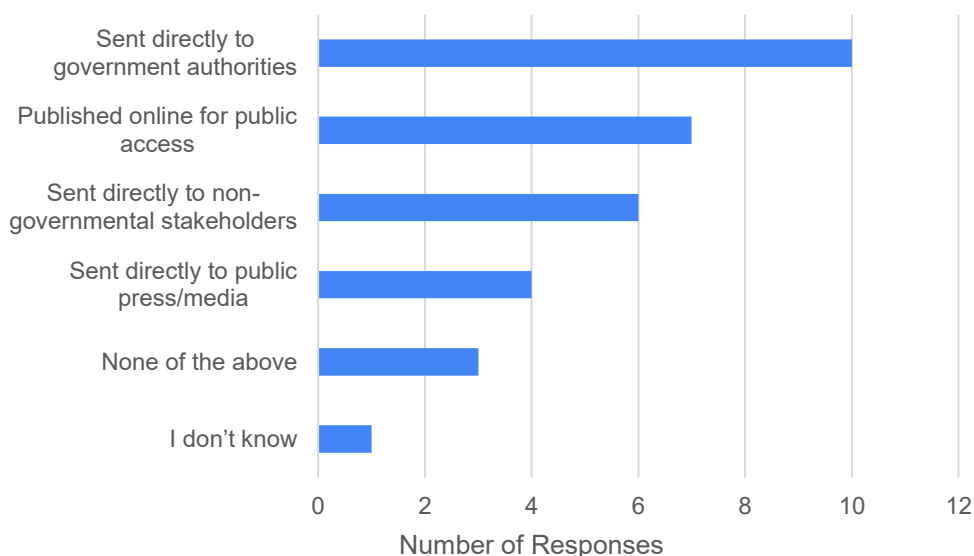
Most countries (10) report their results through technical reports, while a few countries (5) utilize online bulletins, dashboards or interactive online maps to report their results. Only one country reports its results with physical bulletin boards (e.g. at beaches).



54. Which of the following methods are used to share the reports of your country's coastal water quality monitoring program? (Choose all that apply)

Most countries (10) send their results directly to government authorities, while others publish their report online for public access (7), send them directly to non-government stakeholders (6) or to the public press/media (4).

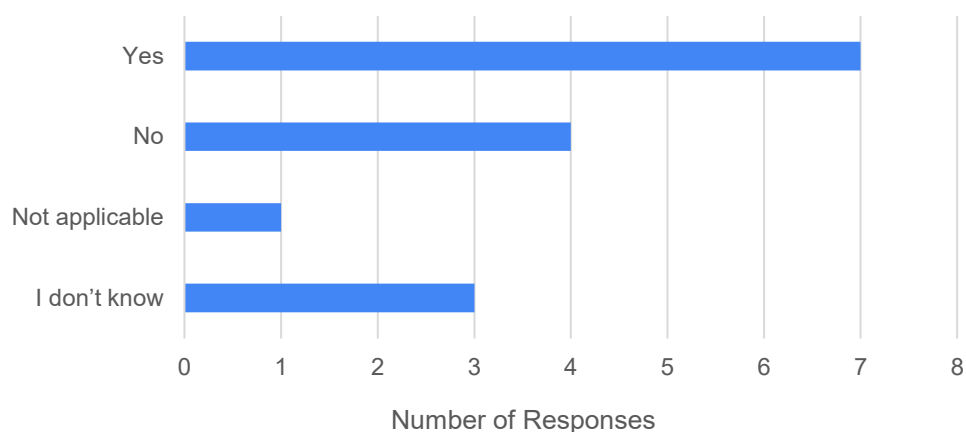
### Report Sharing Method



55. Does your country's coastal water quality monitoring program use standardized reporting templates or protocols when sharing results with other organizations or governmental agencies? (Choose one)

Half of the survey respondents (7) confirmed the use of standardized reporting templates or protocols when sharing results with other organizations or governmental agencies.

### Use of Standardized Reporting Templates or Protocols

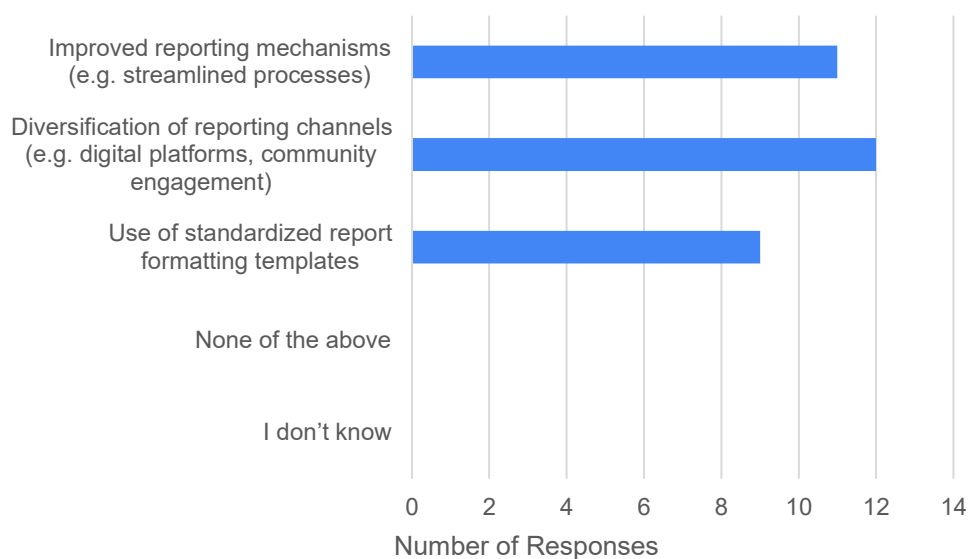


56. In your opinion, which aspects of reporting in your country's coastal monitoring program could benefit most from capacity development? (Choose all that apply)

Most of the surveyed countries expressed interest in capacity development to diversify their reporting channels (12) through, for example, digital platforms or community engagement, to improve their reporting mechanisms with streamlined processes (11), and in the use of standardized report formatting templates (9).



## Reporting Training Needs



57. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges in the reporting of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- Central repositories and trained analysts are needed at the national level to interpret and report on the results.
- Reporting/results presentation is a challenge and capacity development should differentiate between different forms of reporting/results presentation depending on the final recipient of the report/result (target audience).
- A review of standardization of data reporting documents would be recommended.

## **Section 8: Financial, Infrastructure & Human Resources**

### *Summary*

Nearly all 22 respondents confirmed that financial limitations significantly impact their country's coastal water quality monitoring programs. Most also see a need for capacity development in securing international funding and forming partnerships to pool resources.

Infrastructure constraints (14) and transportation limitations (20) are common, while nearly all respondents cited challenges in acquiring new field or lab equipment. The majority of countries (8) use equipment between 5-10 years old, five have newer equipment (2-5 years old), and three rely on equipment over 10 years old. Most countries (17) reported that maintaining or repairing equipment is a major limitation.

Key challenges in acquiring field or lab supplies include lack of funding (17), long delivery times (14), and absence of local suppliers (14), with fewer citing import/export restrictions (5), high import costs (1), and supply chain issues (1).

Capacity development priorities for equipment expertise include training in new equipment for emerging contaminants (20), modern equipment for traditional contaminants (19), in-house maintenance (18), recordkeeping (16), and calibration/accuracy verification (15).

Staff shortages were reported by most countries (15), with only four confirming sufficient personnel. The main limitations regarding staff capacity include insufficient funding (15), limited training opportunities (14), a lack of qualified personnel (13), high staff turnover (11), low salaries (1), and a lack of government hiring (1).

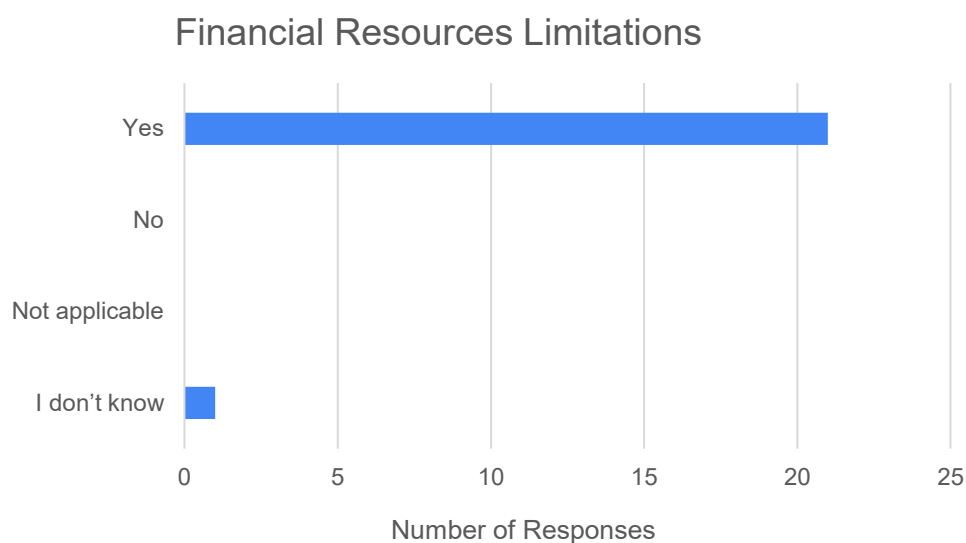
Skill gaps among staff include data analysis and interpretation (16), advanced equipment use (16), GIS/spatial analysis (15), communication with decision-makers (11), laboratory analysis (11), report writing (10), field sampling techniques (7), and stakeholder engagement (7).

Additional recommendations include enabling tax-free equipment purchases, leveraging international projects to contribute equipment, and providing training for citizen science monitors.

### *Individual Questions*

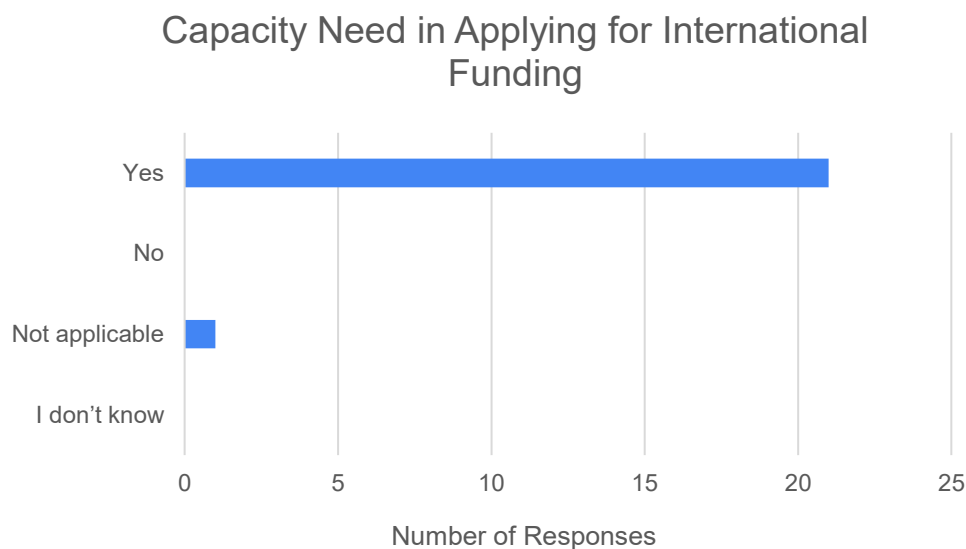
58. Are insufficient financial resources a significant limitation affecting the operations of your country's coastal water quality monitoring program? (Choose one)

Unsurprisingly, nearly all respondents confirmed that financial resources are a significant limitation affecting the operations of their country's coastal water quality monitoring program.



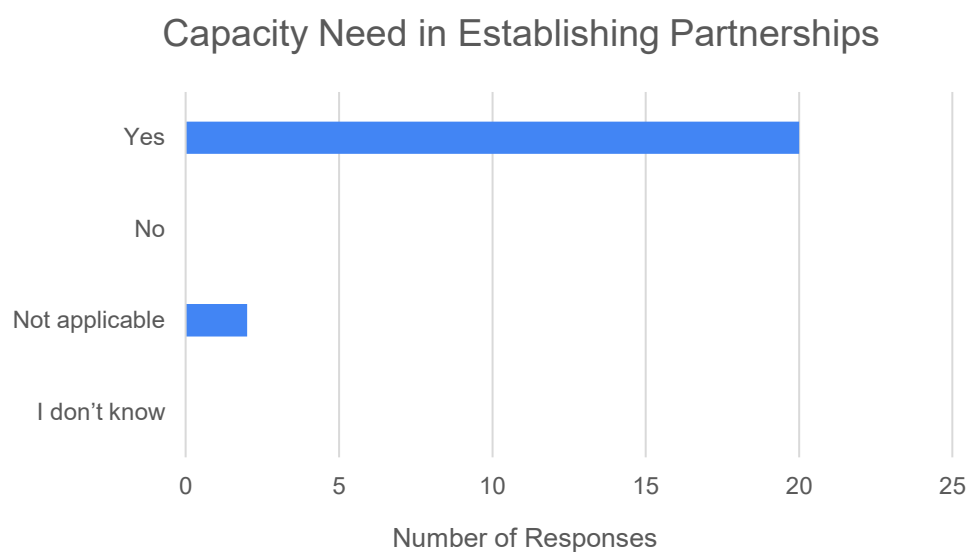
59. In your opinion, could your country's coastal monitoring program benefit from capacity development on strategies to apply for international project funding?  
(Choose one)

Similar to the previous question's responses, nearly all countries confirmed that their coastal monitoring programs could benefit from capacity development on strategies to apply for international project funding.



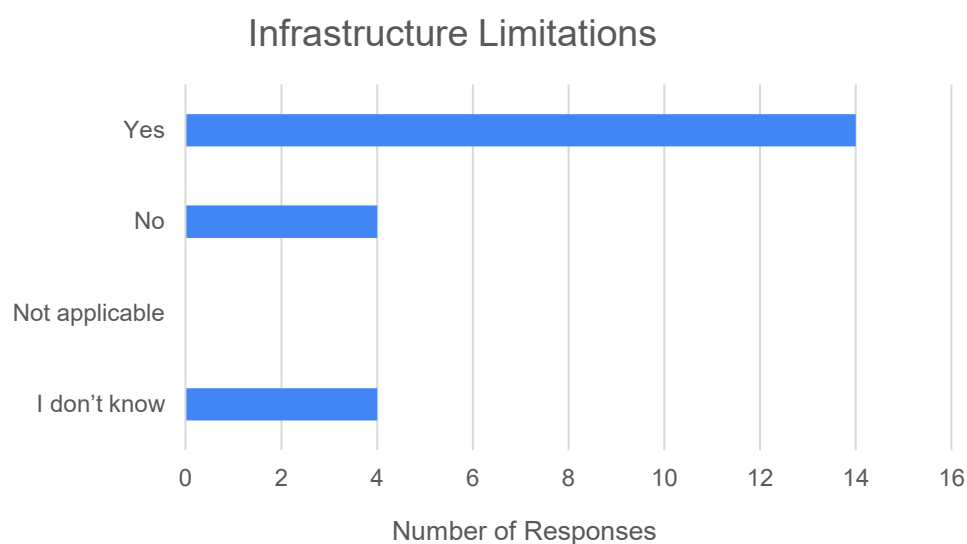
60. In your opinion, could your country's coastal monitoring program benefit from capacity development in establishing partnerships with organizations (research, private, governmental, etc.) to pool resources? (Choose one)

Nearly all respondents believe that their country's coastal monitoring program could benefit from capacity development in establishing partnerships with other organizations to pool resources.



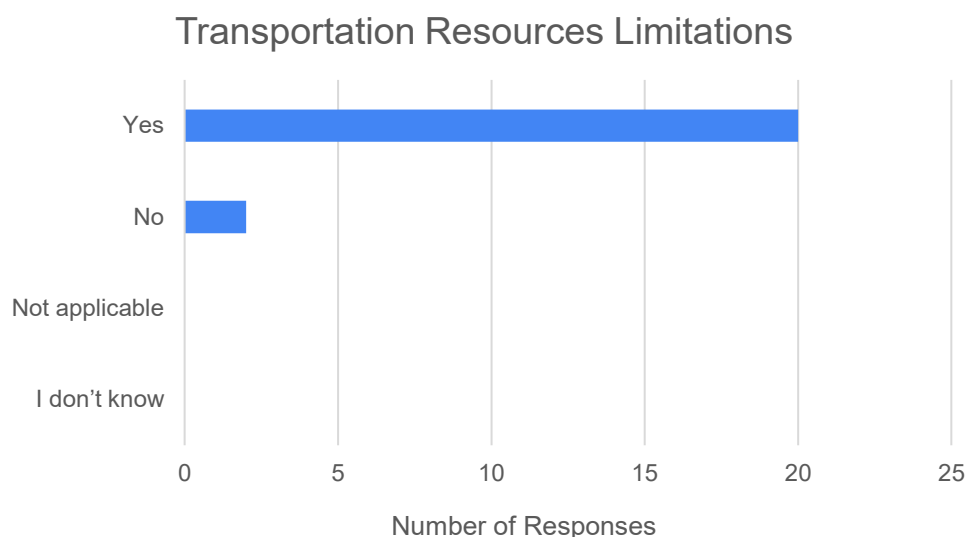
61. Are there infrastructure limitations (e.g. lack of storage facilities, power supply issues) that significantly affect the operations of your country's coastal water quality monitoring program? (Choose one)

Many respondents (14) stated that infrastructure limitations significantly affect the operations of their monitoring program.



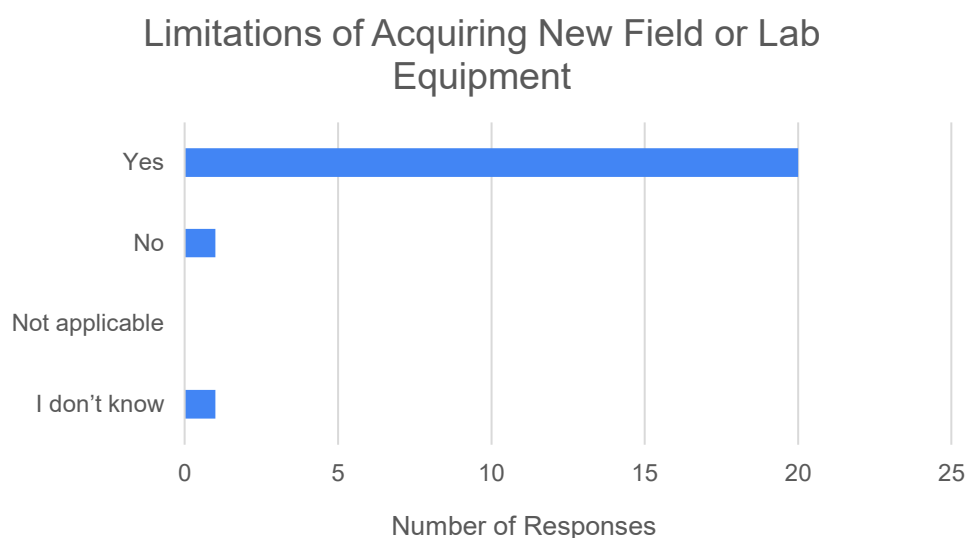
62. Are transportation resources (e.g. vehicles, boats, gasoline) a significant limitation affecting the operations of your country's coastal water quality monitoring program? (Choose one)

Nearly all respondents stated that transportation resources are a significant limitation affecting the operations of their monitoring program.



63. Is the capacity to acquire new field or laboratory equipment a significant limitation to the operations of your country's coastal water quality monitoring program?  
(Choose one)

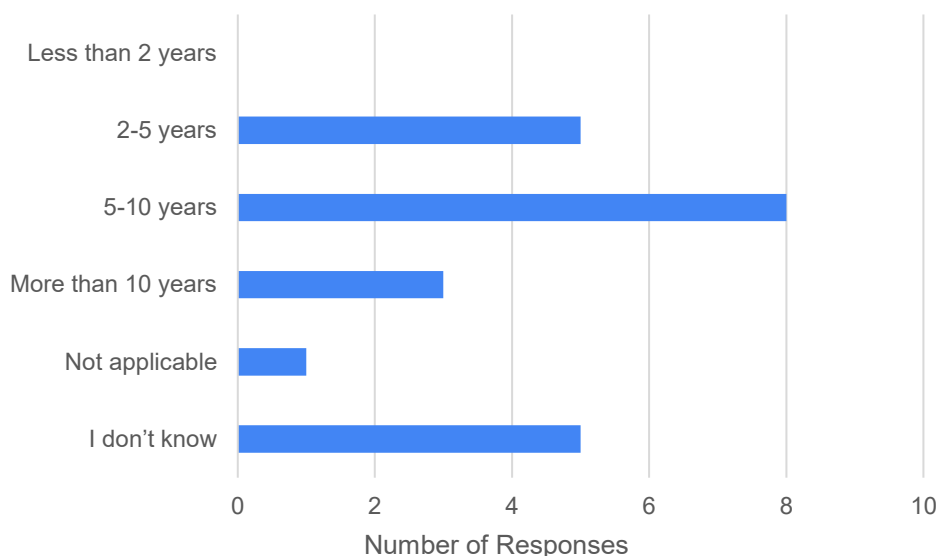
Nearly all respondents stated that acquiring new field or laboratory equipment is a significant limitation affecting the operations of their monitoring program.



64. How many years of use, on average, would you say the field and laboratory equipment have in your country's coastal water quality monitoring program?  
(Choose one)

The majority of countries (8) stated that their field and lab equipment have between 5-10 years of use, while five countries have relatively new equipment with just 2-5 years of use. Three countries depend on equipment with over 10 years of use.

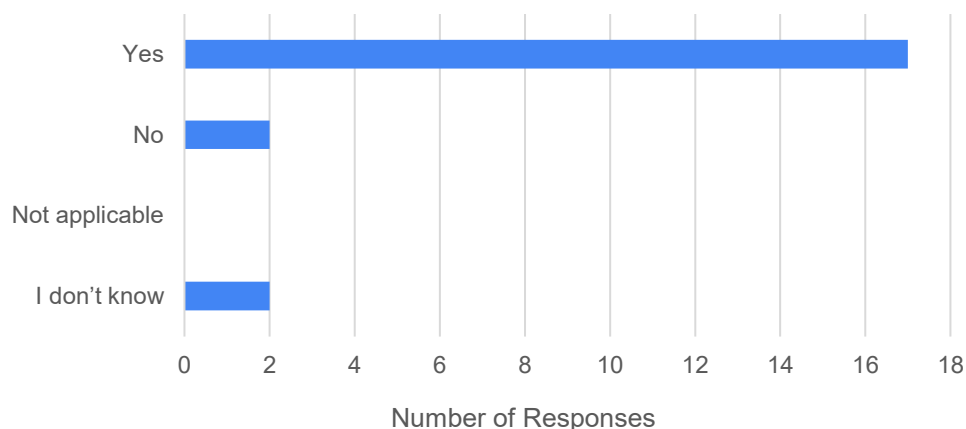
### Years of Use of Field and Lab Equipment



65. Is the capacity to repair or perform maintenance on field or laboratory equipment a significant limitation to the operations of your country's coastal water quality monitoring program? (Choose one)

Most countries (17) stated that the capacity to repair or perform maintenance on field or laboratory equipment is a significant limitation to the operations of their monitoring program.

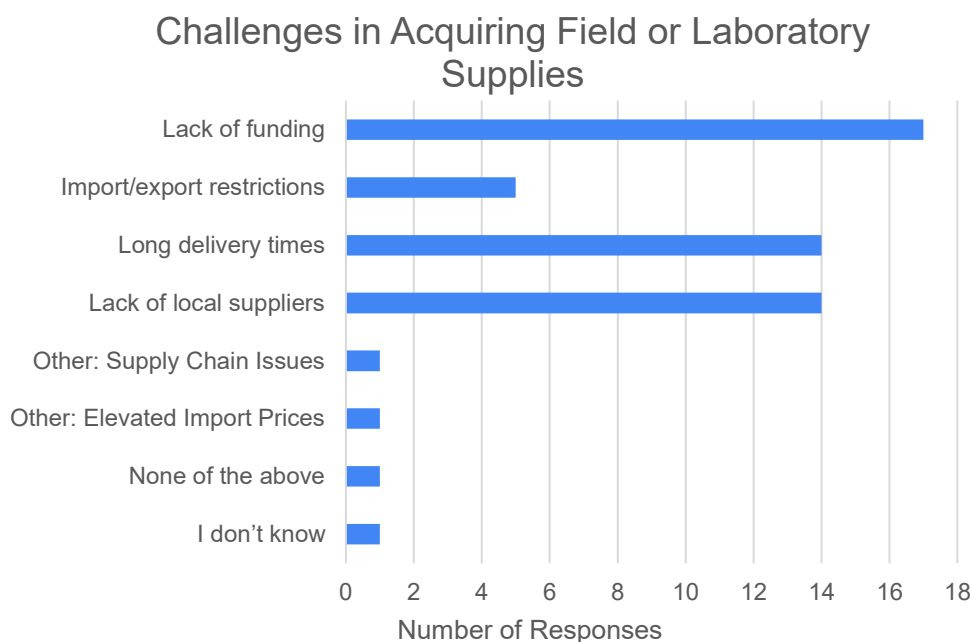
### Limitations to Repair or Perform Maintenance on Field or Lab Equipment



66. What are the main challenges faced in acquiring field or laboratory supplies (e.g. reagents, replacement parts) for your country's coastal water quality monitoring program? (Choose all that apply)

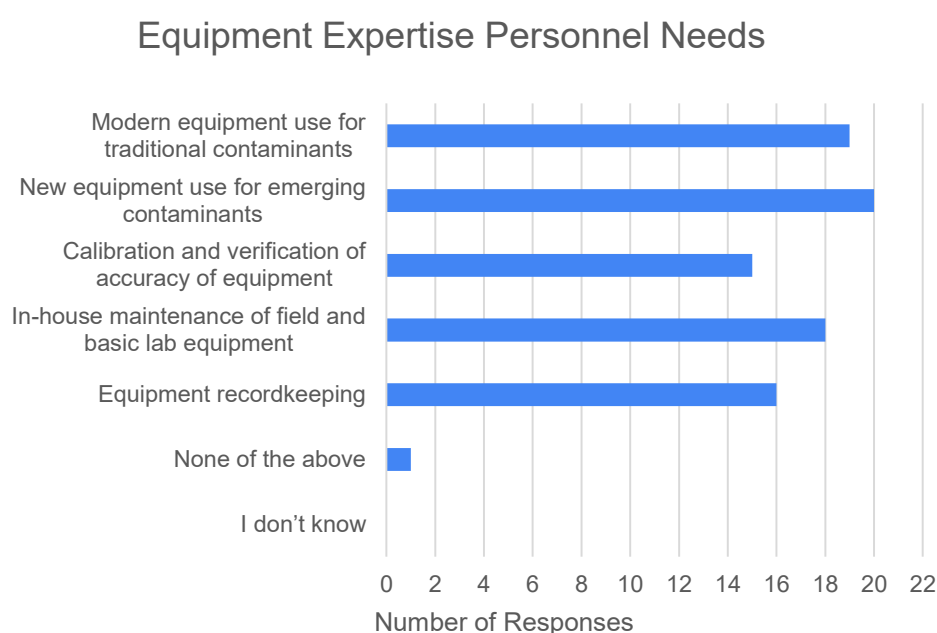
The main challenges faced in acquiring field or laboratory supplies were identified as lack of funding (17), long delivery times (14) and lack of local suppliers (14), with fewer

respondents identifying import/export restrictions (5), elevated import prices (1) and supply chain issues (1).



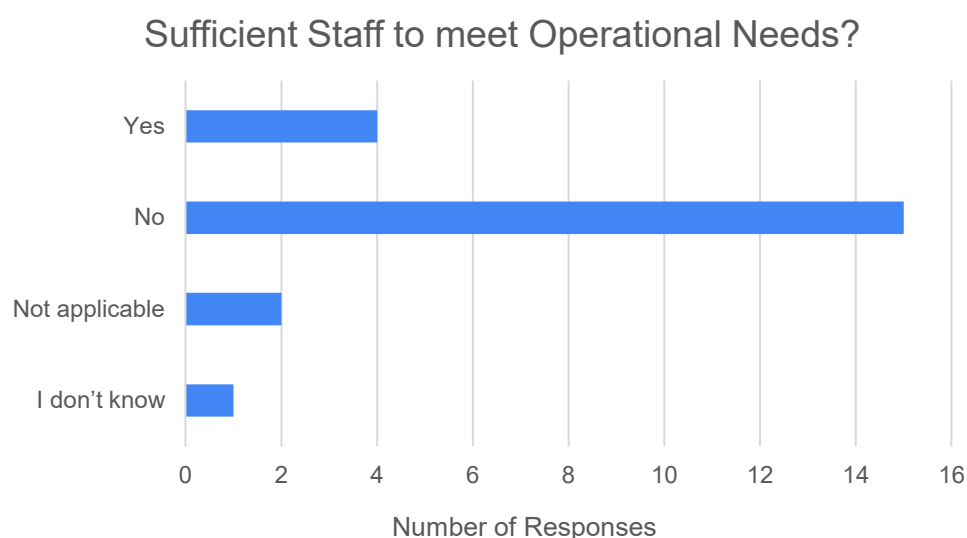
67. In your opinion, which aspects of equipment expertise could personnel working in your country's coastal monitoring program benefit most from capacity development? (Choose all that apply)

Respondents expressed interest in capacity development for personnel in the following aspects of equipment expertise: new equipment use for emerging contaminants (20), modern equipment use for traditional contaminants (19), in-house maintenance of field and basic lab equipment (18), equipment recordkeeping (16), and calibration and verification of accuracy of equipment (15).



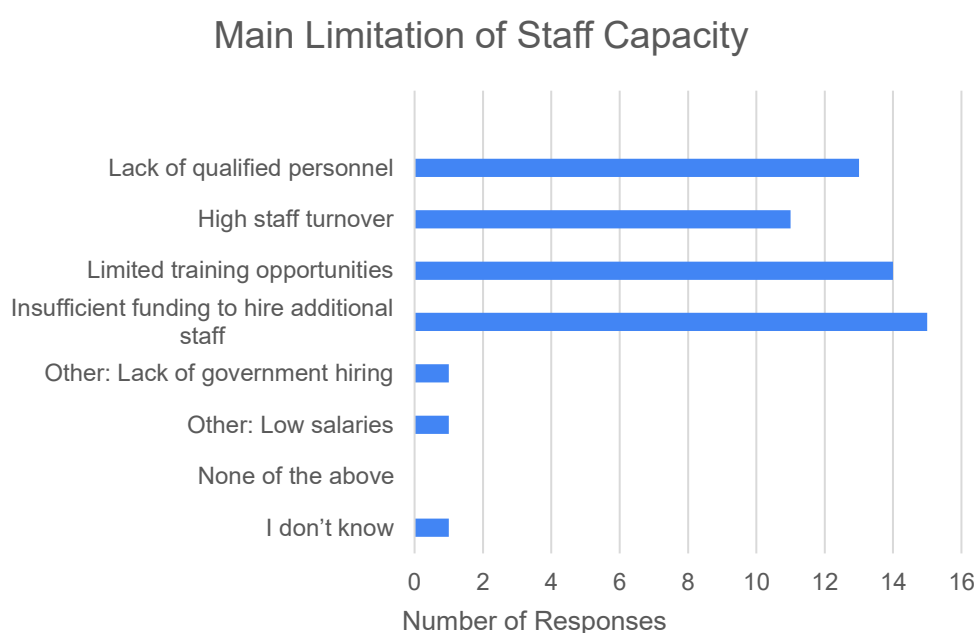
68. Does your country's coastal water quality monitoring program have sufficient staff to meet its operational needs? (Choose one)

Most surveyed countries (15) do not have sufficient staff to meet its monitoring program's operational needs, while only four respondents stated that yes, they do have sufficient staff.



69. What is the main limitation regarding staff capacity in your country's coastal water quality monitoring program? (Choose all that apply)

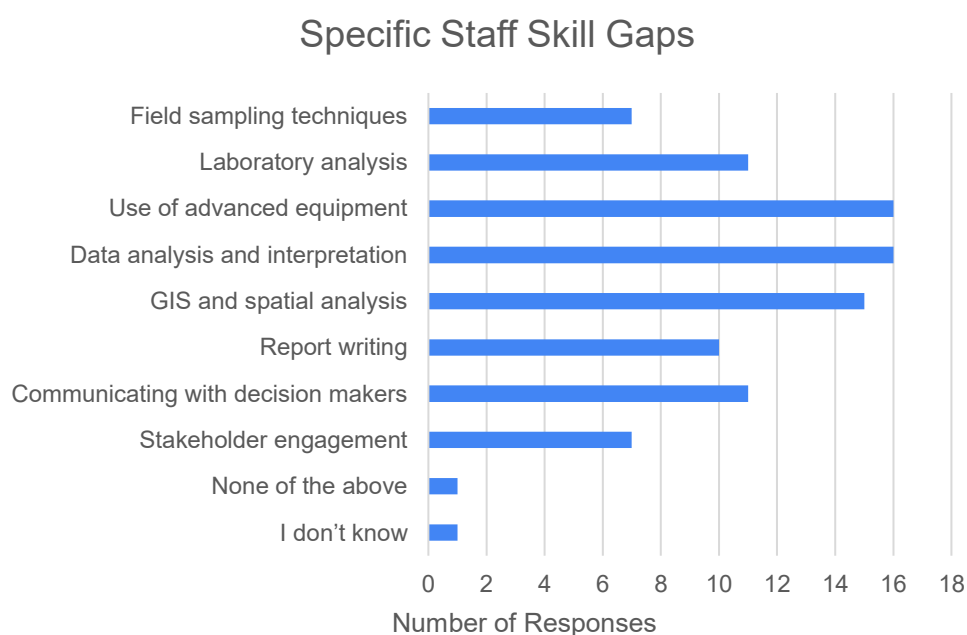
The main limitation regarding staff capacity were identified as insufficient funding to hire additional staff (15), limited training opportunities (14), lack of qualified personnel (13), high staff turnover (11), low salaries (1) and lack of government hiring (1).





70. Are there any specific skill gaps among the staff of your country's coastal water quality monitoring program? (Choose all that apply)

The most common specific skill gaps among staff were identified as data analysis and interpretation (16), use of advanced equipment (16), GIS and spatial analysis (15), communicating with decision makers (11), laboratory analysis (11), report writing (10), field sampling techniques (7) and stakeholder engagement (7).



71. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges in financial resources and infrastructure of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- Available funding opportunities in the area of land-based sources monitoring are lacking.
- The purchase of tax-free equipment for monitoring is an important avenue for renewing the technology in the region.
- Contributions of equipment through international projects is an effective strategy to strengthen institutions.
- The expansion of the environmental laboratories to implement new analysis methodologies to broaden the range of chemical analysis in different types of environmental matrices would be beneficial.
- Training for citizen science monitoring programs would be advantageous.

## **Section 9: Informing Decision-Makers**

### *Summary*

Most monitoring programs communicate results to decision-makers through technical reports (15), with ten also using executive summaries and in-person meetings. Fewer prepare cabinet briefs and papers (7) or issue monthly bulletins or dashboards (2).

Only nine of the 22 respondents confirmed using a knowledge translation process, or highlighting the impacts on ecosystem health, ecosystem services or human health in their reports. Fewer emphasize impacts on the economy (6).

Direct actions by decision-makers in response to monitoring results have been observed by 14 respondents, including temporary beach closures (11), community engagement (8), beach warnings (8), increased regulation of wastewater discharges (6), new water quality standards or discharge limits (6), ecosystem recovery interventions (6), increased regulation of upstream activities (5), and closure of ports or industrial sites (3).

Most respondents (16-17) expressed interest in capacity development to better communicate monitoring results to decision-makers by relating them to human health, the economy, ecosystem health, and ecosystem services, as well as improving knowledge translation and delivery approaches.

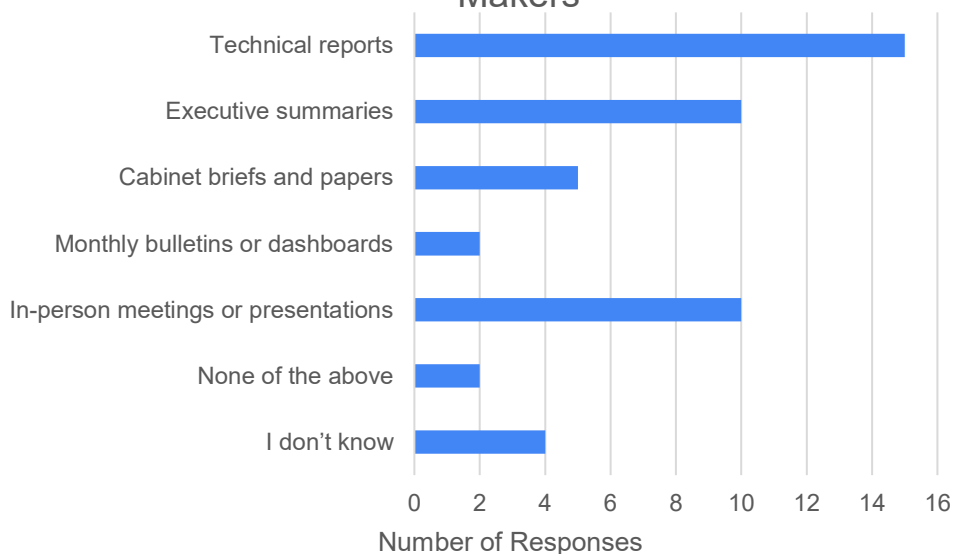
Additional recommendations for informing decision-makers include using GIS-based spatial distribution maps, comparing results with national or regional water quality standards, establishing protocols for actions to be taken in events of environmental contamination, and training personnel for epidemiological water surveillance to prevent waterborne diseases.

### *Individual Questions*

72. Through which of the following channels are the results of your country's coastal water quality monitoring program delivered to decision-makers in a position to control pollution? (Choose all that apply)

Most monitoring programs communicate their results to decision-makers through technical reports (15), while ten countries also utilize executive summaries and in-person meetings or presentations. Seven countries prepare cabinet briefs and papers while two prepare monthly bulletins or dashboards.

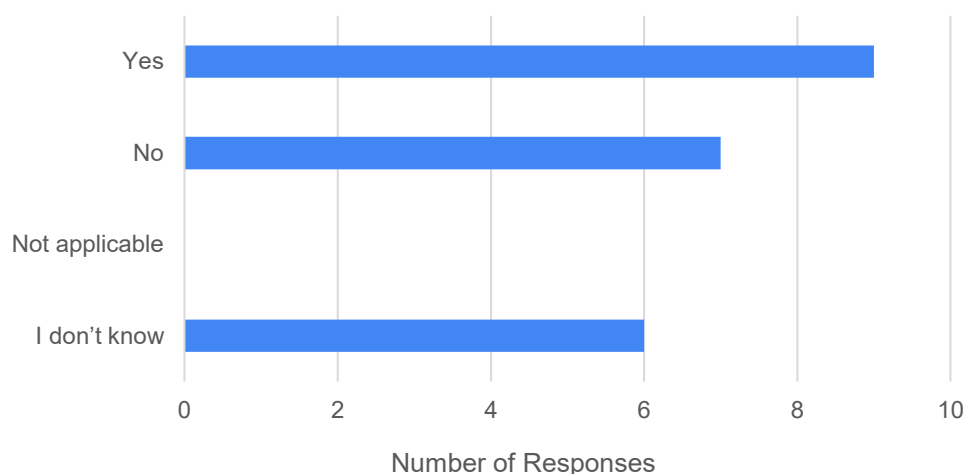
### Channels for Delivering Results to Decision-Makers



73. Does your country's coastal water quality monitoring program apply some sort of process of "knowledge translation" to present its research results in terms that can be easily understood by decision-makers in a position to control pollution? (Choose one)

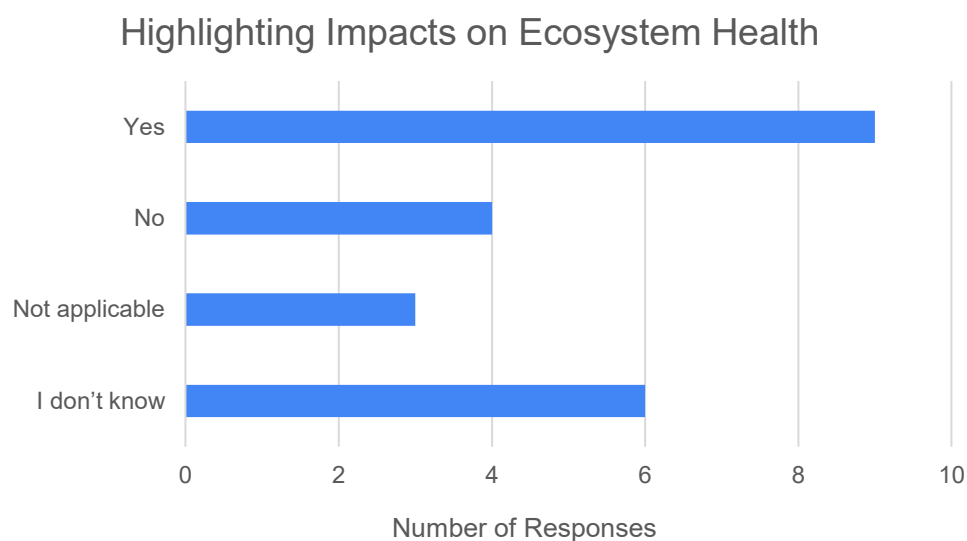
Only nine of the 22 survey respondents confirmed the use of a knowledge translation process to present its results to decision makers.

### Application of "Knowledge Translation" Process



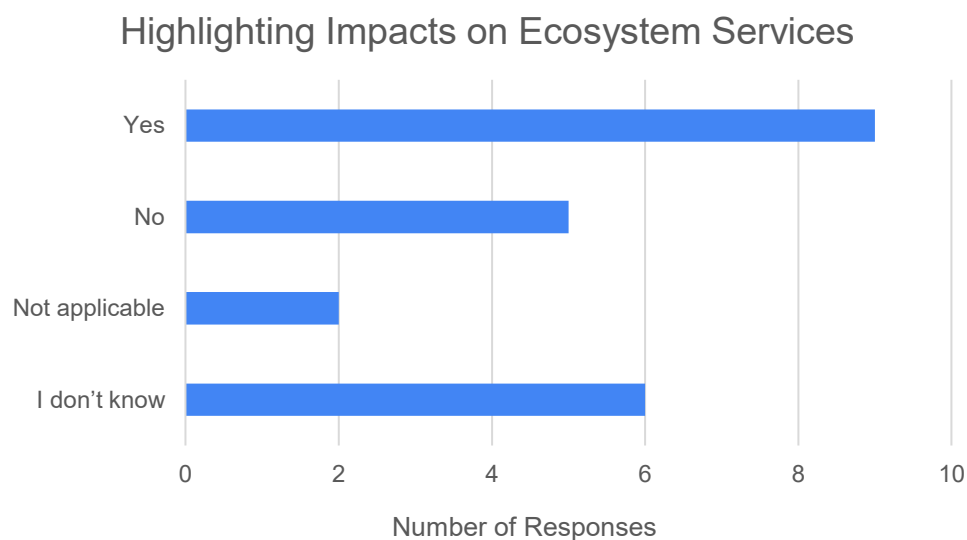
74. Are **impacts on ecosystem health** highlighted in the information delivered to decision-makers as part of your country's coastal water quality monitoring program? (Choose one)

Nine of the 22 survey respondents confirmed that impacts on ecosystem health are highlighted in the information delivered to decision-makers.



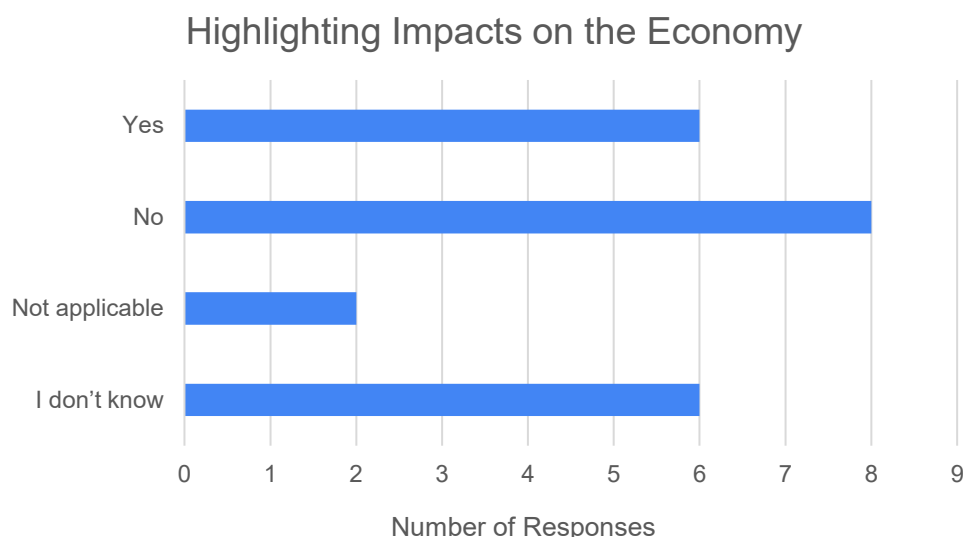
75. Are **impacts on ecosystem services** highlighted in the information delivered to decision-makers as part of your country's coastal water quality monitoring program? (Choose one)

Nine of the 22 survey respondents confirmed that impacts on ecosystem services are highlighted in the information delivered to decision-makers.



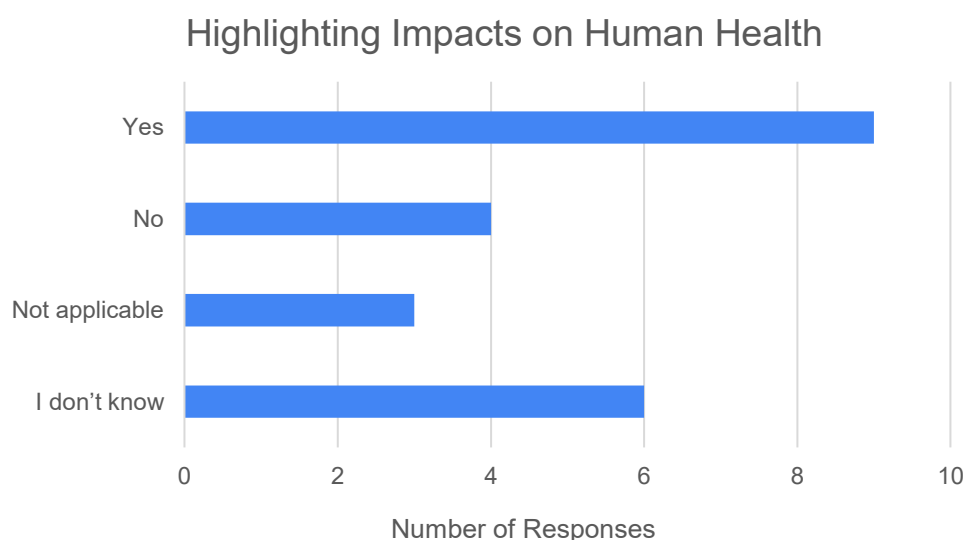
76. Are **impacts on the economy** highlighted in the information delivered to decision-makers as part of your country's coastal water quality monitoring program? (Choose one)

Just six of the 22 survey respondents confirmed that impacts on the economy are highlighted in the information delivered to decision-makers.



77. Are **impacts on human health** highlighted in the information delivered to decision-makers as part of your country's coastal water quality monitoring program? (Choose one)

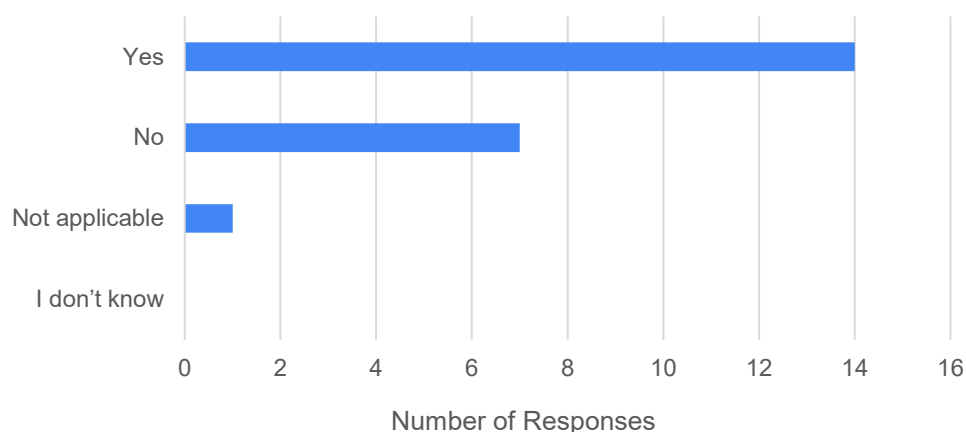
Nine of the 22 survey respondents confirmed that impacts on human health are highlighted in the information delivered to decision-makers.



78. In your experience, have you observed direct actions taken by decision-makers in response to results of your country's coastal water quality monitoring? (Choose one)

14 surveyed respondents have observed direct actions taken by decision-makers in response to results of their national coastal water quality monitoring program.

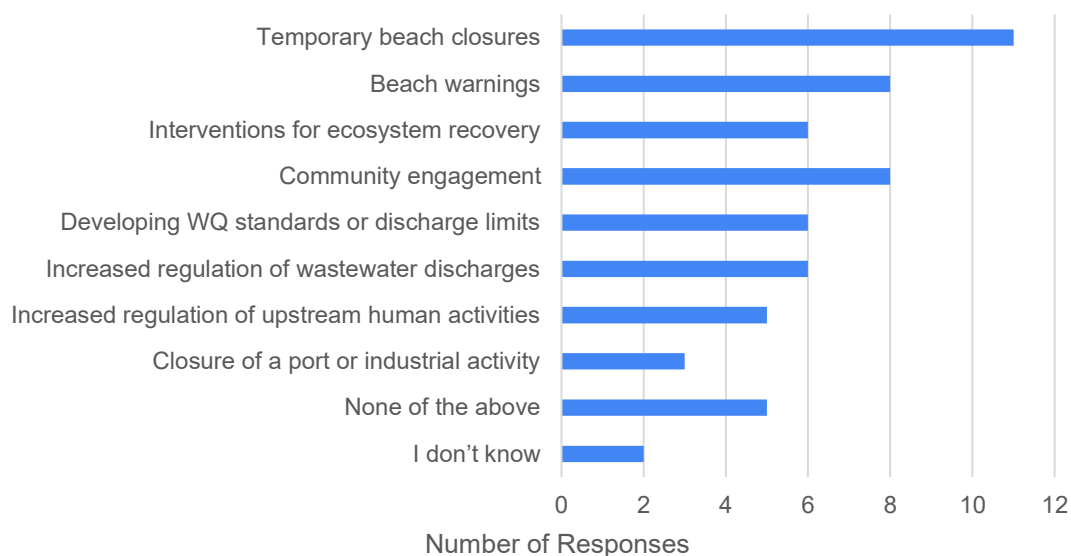
### Observed Direct Actions Taken By Decision-Makers



79. Which of the following actions, if any, have been taken by decision-makers and/or governmental authorities in response to results of your country's coastal monitoring? (Choose all that apply)

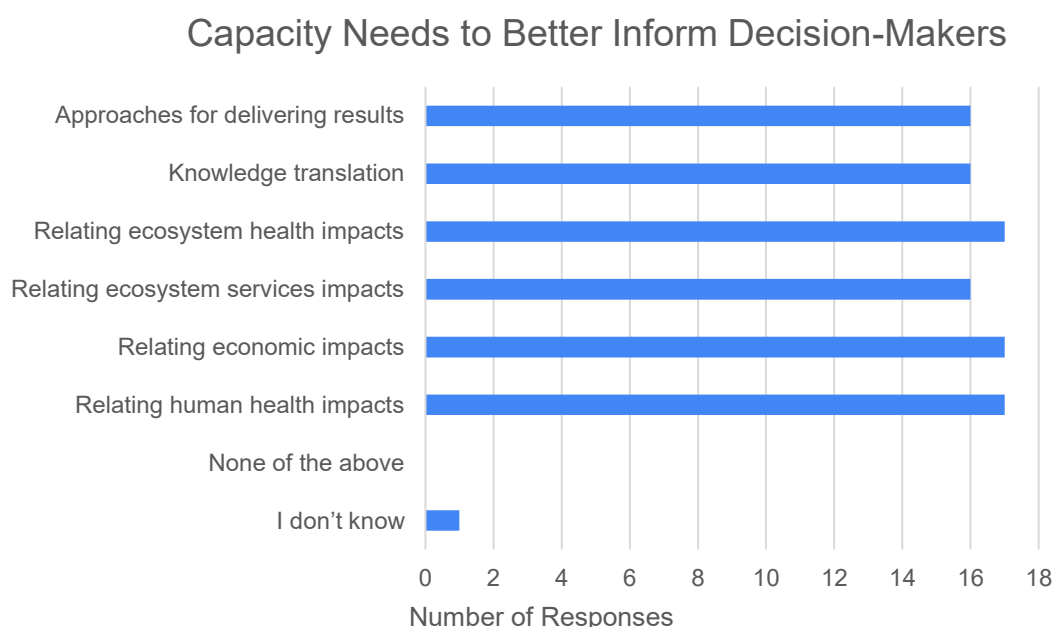
Actions taken by decision-makers and/or governmental authorities in response to coastal monitoring results have included temporary beach closures (11), community engagement (8), beach warnings (8), increased regulation of wastewater discharges (6), developing water quality standards or discharge limits (6), interventions for ecosystem recovery (6), increased regulation of upstream human activities (5) and closure of a port or industrial activity (3).

### Actions Taken By Decision-Makers



80. In your opinion, which aspects of informing decision-makers could your country's coastal monitoring program benefit most from capacity development? (Choose all that apply)

Most respondents (16-17) expressed interest in capacity development to enhance their informing of decision makers by relating the results of their monitoring program to impacts on human health, the economy, ecosystem health and ecosystem services, as well as aspects of knowledge translation and approaches for delivering results.



81. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges related to informing decision-makers as part of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- Monitoring is important to support evidence-based decision making and policies.
- The use of spatial distribution maps (through GIS) is a very visually striking tool to convey information related to coastal water quality to decision makers. It is always recommended to analyze/compare the results obtained in monitoring programs with national or regional standards or criteria for coastal water quality.
- The establishment of protocols for actions to be taken in certain environmental events would be recommended.
- Training for personnel in epidemiological surveillance in water bodies would help counteract pollution to preserve human health from waterborne diseases.
- The involvement of citizens in coastal (including riverine) water quality monitoring programs would be advantageous.
- Specific studies in altered or degraded coastal locations would be recommended in order to execute engineering projects related to their recovery or protection.
- It would be beneficial to establish and execute Integrated Waste and Solid Waste Management projects within coastal areas.

- It is important to identify sources of financing for the implementation of technology and the execution of projects required for the recovery and sanitation of coastal areas.

## **Section 10: Pollution Source Management**

### *Summary*

Most countries have identified the locations of nearby pollution sources, storing this information in maps (13) or databases (11). About half incorporate pollution hotspot identification into their monitoring programs.

Half of the 22 respondents have access to wastewater pollution concentration data, but fewer have information on wastewater treatment types (9) or pollutant loads (4), while four have none of the above. Data on non-point pollution sources is limited, with fewer than half having access to information on agricultural practices (9), spatial distribution (8), mining practices (7), spatial area (6), or pollutant loads (4); five have no access to such data.

Capacity development priorities include wastewater discharge data analysis (19), non-point pollution source analysis (18), pollution hotspot identification (17), and pollution source inventories (17).

Additional challenges and recommendations include inconsistent wastewater discharge and non-point pollution data, improving interoperability between the systems of environmental authorities and national monitoring programs, strengthening institutional response capacity, fostering public-private partnerships, and further studying the balance between subsidies and non-point source management practices.

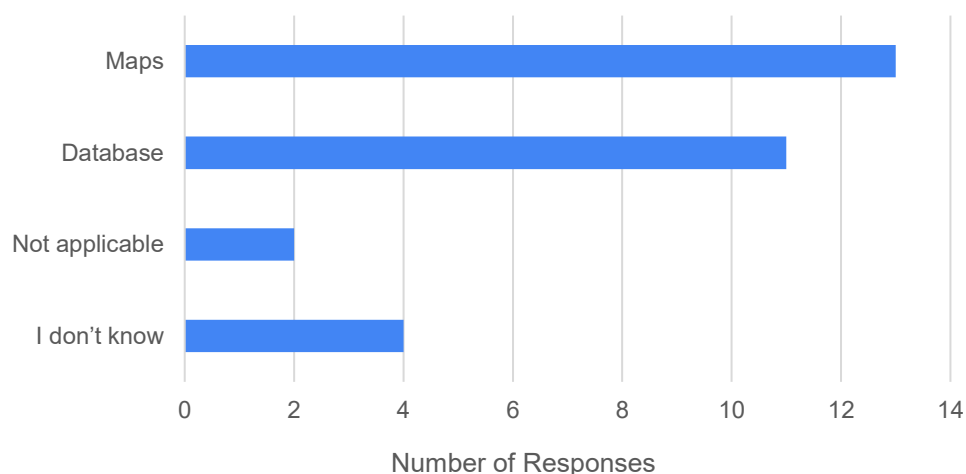
### *Individual Questions*

82. Are the locations of pollution sources in the area of your country's coastal water quality monitoring program stored using any of the following methods? (Choose all that apply)

Most countries have identified the locations of nearby pollution sources and stored this information in maps (13) or databases (11).



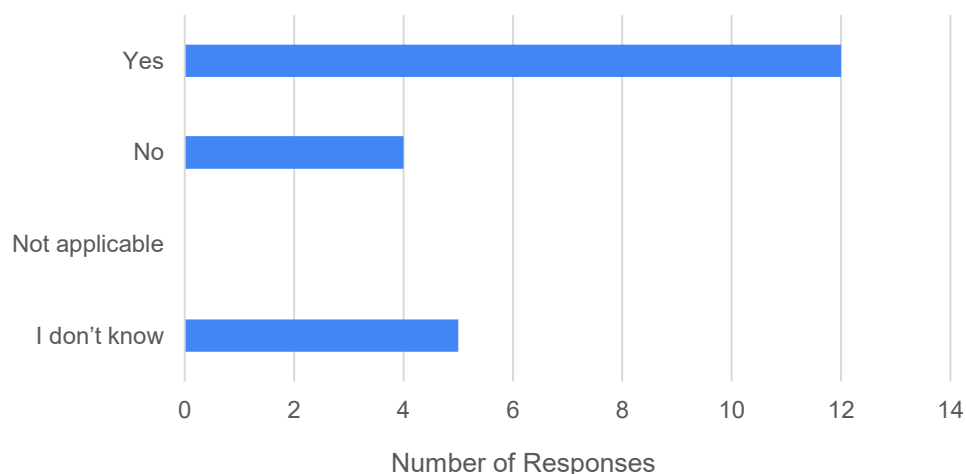
### How Pollution Source Locations are Stored



83. Are areas of increased pollution (i.e. “hotspots”) identified as part of your country’s coastal water quality monitoring program? (Choose one)

About half of the surveyed countries identify hotspots of pollution as part of their monitoring program.

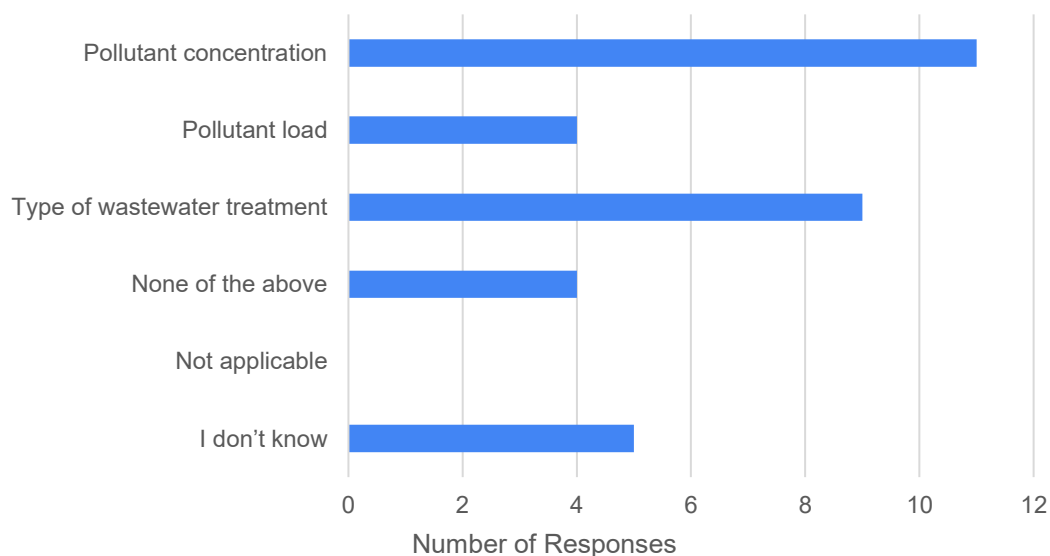
### Identification of Pollution Hotspot Areas



84. Which of the following data on wastewater discharges (domestic or industrial) are available to your country’s coastal water quality monitoring program? (Choose all that apply)

Half of the 22 surveyed respondents have access to wastewater pollution concentration data. Relatively few have information on the type of wastewater treatment (9) or pollutant loads (4), while four responded “none of the above”.

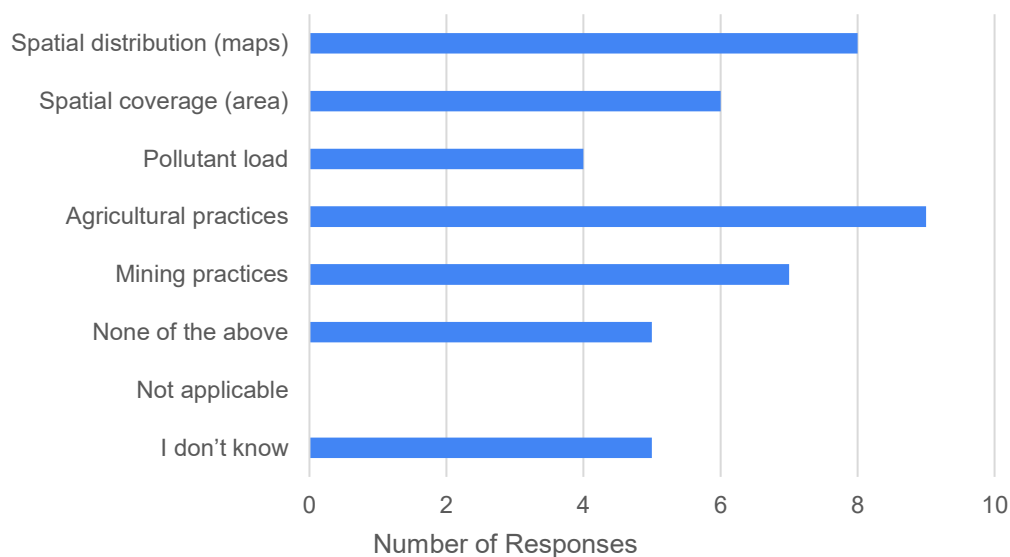
### Available Wastewater Discharges Data



85. Which of the following data on non-point pollution sources (e.g. runoff from agricultural fields, urban areas, mining areas, etc.) are available to your country's coastal water quality monitoring program? (Choose all that apply)

Data on non-point pollution sources is relatively scarce with less than half of respondents have access to data on agricultural practices (9), spatial distribution (8), mining practices (7), spatial area (6) and pollutant load (4), while five have access to none of the above.

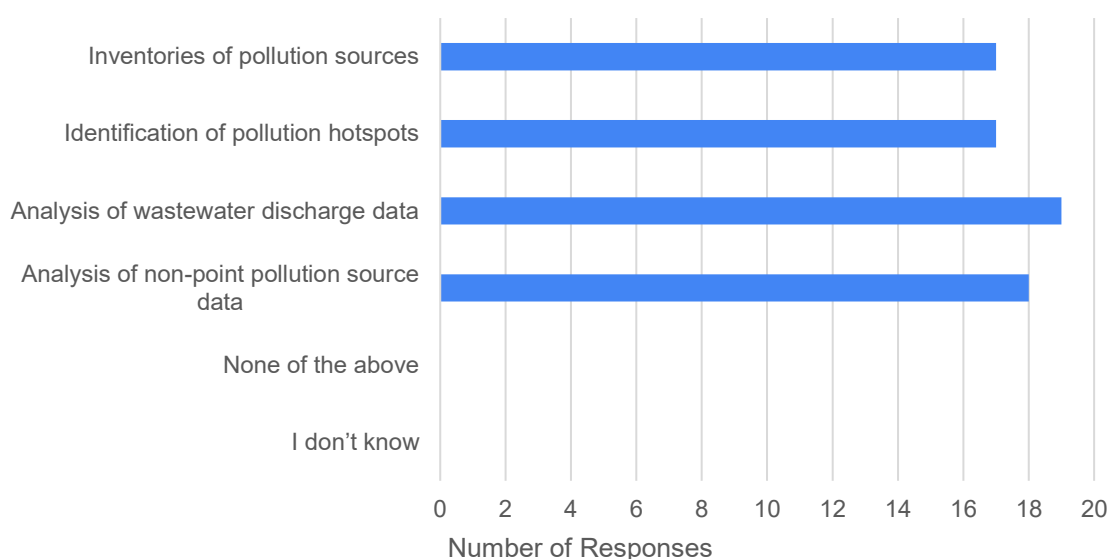
### Available Non-Point Pollution Sources Data



86. In your opinion, which aspects of Pollution Source Management could your country's coastal monitoring program benefit most from capacity development? (Choose all that apply)

Most respondents expressed interest in capacity development in the following aspects of pollution source management: analysis of wastewater discharge data (19), analysis of non-point pollution source data (18), identification of pollution hotspots (17), and inventories of pollution sources (17).

### Pollution Source Management Capacity Needs



87. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges related to pollution source management as part of your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- The use of fertilizers and pesticides at resorts for maintaining a green garden year-round, having a semi-arid climate, remains a significant challenge.
- Other challenges include lack of information on the consistency of wastewater discharge data and non-point pollution sources.
- The interoperability of environmental authorities' information systems with national monitoring information systems remains a limitation to making more robust analyses.
- The assessment of the management of polluting sources is an essential part of coastal water quality monitoring programs - they should not be separated. Such assessments of marine pollution sources may include inventory, characterization, level of implementation of corrective measures and management tools, as well as the assessment of the quality of the water surface (water, sediments, organisms) of these ecosystems.
- Institutional strengthening for response, as well as public-private alliance, are recommended.

- It would be beneficial to establish a data analysis program for non-point sources of pollution.
- Further studies need to be conducted to balance the challenges associated with subsidies and implementing non-point source management practices.

## **Section 11: Policy Formulation**

### *Summary*

Policy updates on pollution control and water quality criteria are infrequent, with most occurring every 20+ years (8) or every 10-20 years (5), while only a few update every 5-10 years (3) or less than every 5 years (1).

Most respondents (15) confirmed alignment between national policies and international agreements. Coastal and marine policies in the surveyed countries cover coastal/marine water classification (15), wastewater discharge limits (12), ambient water quality standards (12), beach water quality standards (11), wastewater treatment targets (9), and wastewater/sludge reuse standards (8).

However, only seven respondents indicated a clear link between marine water quality standards and wastewater discharge limits in national policies. Additionally, just 10 of 22 confirmed mechanisms exist to enforce coastal water quality policies.

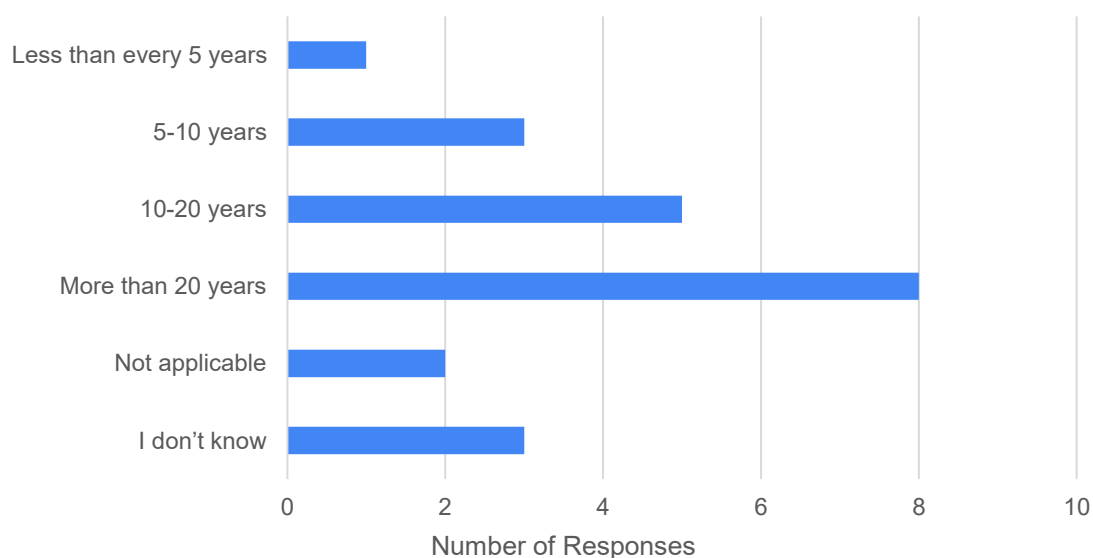
Capacity development priorities include strengthening connections between discharge limits and water quality standards (19), improving wastewater/sludge reuse standards (16), wastewater treatment targets (16), international agreement alignment (16), wastewater discharge limits (14), coastal/marine water classification (14), beach water quality standards (13), and ambient water quality standards (13).

### *Individual Questions*

88. How often are policies related to pollution control or water quality criteria updated in your country? (Choose one)

Response evidence the challenges of updating policies related to pollution control or water quality criteria as in most cases such policies are only updated at over a 20-year period (8) or every 10-20 years (5). In a few countries, such policies are updated every 5-10 years (3) or less than every 5 years (1).

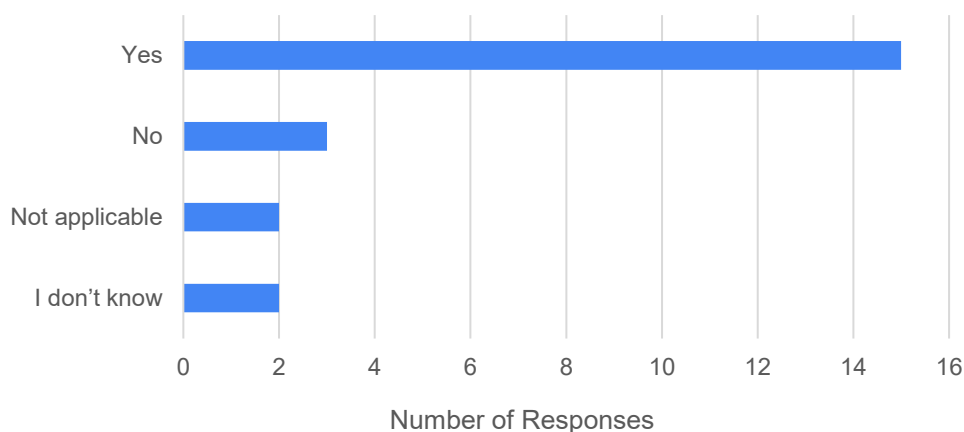
### Update Frequency of Pollution Control Policies



89. Are policies related to pollution control or water quality criteria in your country aligned with international agreements (e.g. Cartagena Convention)? (Choose one)

Most respondents (15) confirmed that policies related to pollution control or water quality criteria in their country aligned with international agreements.

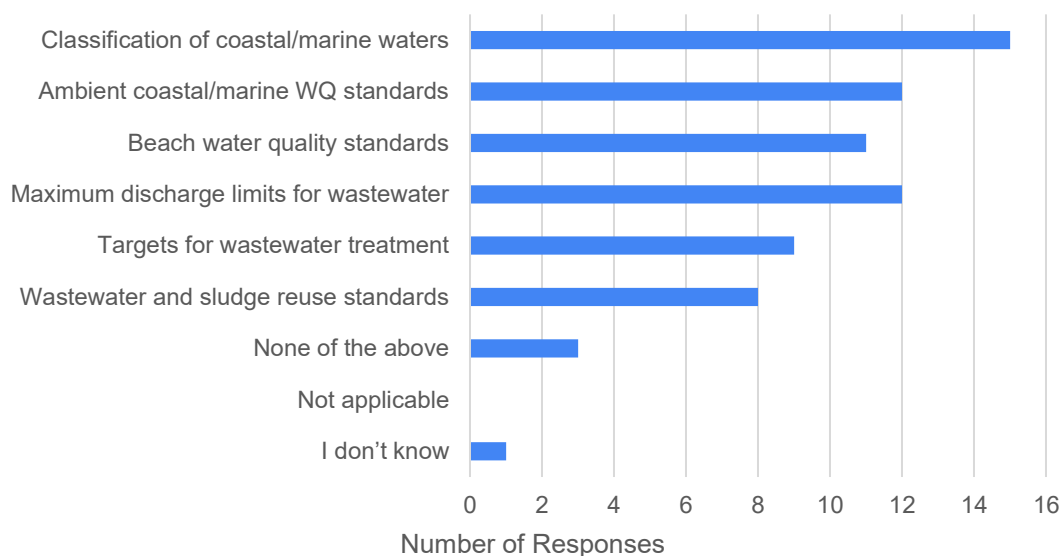
### Pollution Policies Aligned with International Agreements



90. Which of the following aspects are defined by policies related to coastal/marine areas in your country? (Choose all that apply)

Coastal/marine policies in the surveyed countries cover the following: classification of coastal/marine waters (15), maximum discharge limits for wastewater (12), ambient coastal/marine water quality standards (12), beach water quality standards (11), targets for wastewater treatment (9), and wastewater and sludge reuse standards (8).

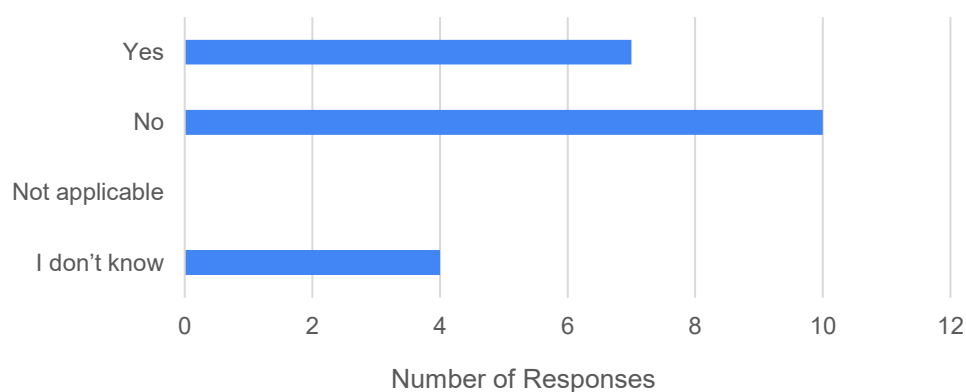
### Aspects Defined by Coastal/Marine Policies



91. Is there a clear and explicit connection between marine water quality standards and maximum wastewater discharge limits in policies related to coastal/marine areas in your country? (Choose one)

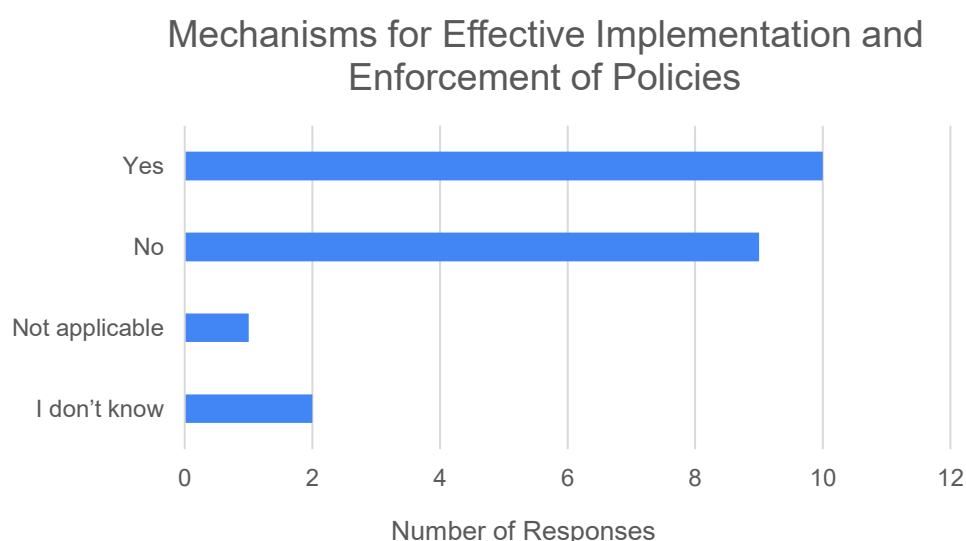
Only seven respondents affirmed that there is a clear and explicit connection between marine water quality standards and maximum wastewater discharge limits in policies related to coastal/marine areas in their country.

### Explicit Connection Between Marine Water Quality Standards and Maximum Wastewater Discharge Limits



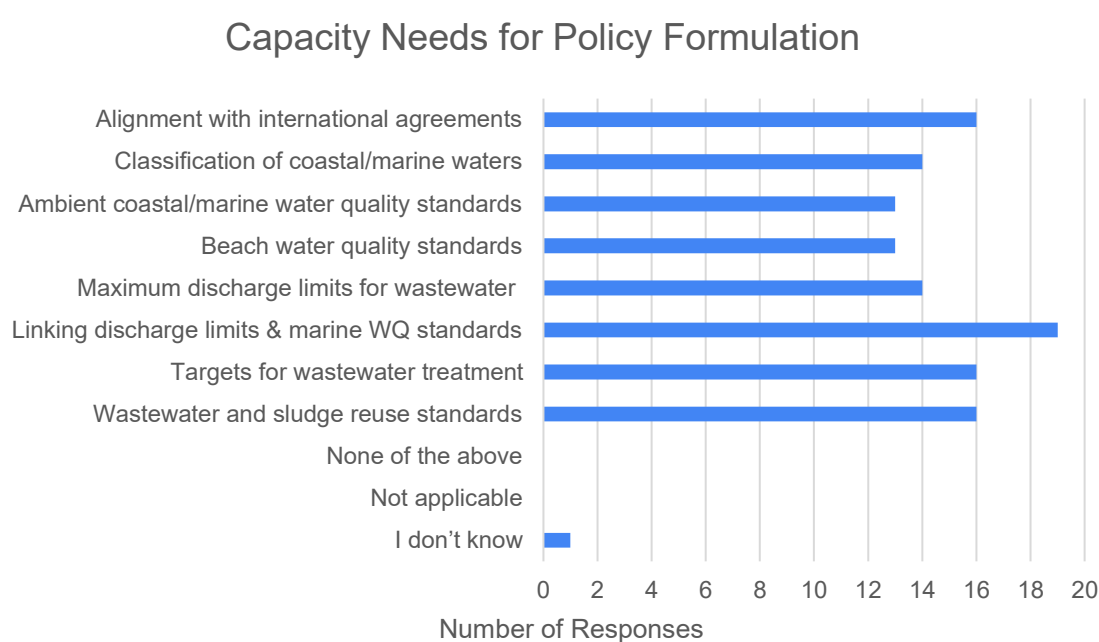
92. Are there mechanisms in place to ensure the effective implementation and enforcement of policies related to coastal water quality in your country? (Choose one)

10 of the 22 surveyed respondents stated that there are mechanisms in place to ensure the effective implementation and enforcement of policies related to coastal water quality in their country.



93. In your opinion, which aspects of policy formulation could your country benefit most from capacity development? (Choose all that apply)

Many respondents expressed interest in capacity development in the following aspects of policy formulation: linking discharge limits & marine water quality standards (19), wastewater and sludge reuse standards (16), targets for wastewater treatment (16), alignment with international agreements (16), maximum discharge limits for wastewater (14), classification of coastal/marine waters (14), beach water quality standards (13), and ambient coastal/marine water quality standards (13).



94. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges regarding policies relevant to your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- In some policies, the standards are out of date with respect to current global challenges.
- It is urgent to update the environmental quality standards for coastal marine waters and include indicators/parameters related to emerging pollutants.
- Some national environmental quality standards for coastal waters only exist for waters used by fisheries and bathing waters (direct and indirect contact), therefore standards or criteria must be approved for other uses (maritime ports, breeding and conservation areas, wastewater receiving bodies, among others).
- Continuous training in the application of environmental policies is needed.

## **Section 12: Public Awareness**

### *Summary*

Most respondents (14) perceive low public awareness of pollution impacts in coastal waters, while seven see a medium level and only one reports high awareness.

Twelve countries' coastal water quality monitoring programs engage in public knowledge-building activities, but only eight incorporate local and traditional knowledge.

Public awareness efforts rely on news outlets (15), social media (13), school programs (12), and community meetings (10). However, only 10 countries make monitoring results freely available to the public.

Capacity development priorities include integrating local and traditional knowledge (19), enhancing public engagement (19), improving data sharing (18), and expanding public dissemination (16). A key challenge is the lack of budget for monitoring campaigns.

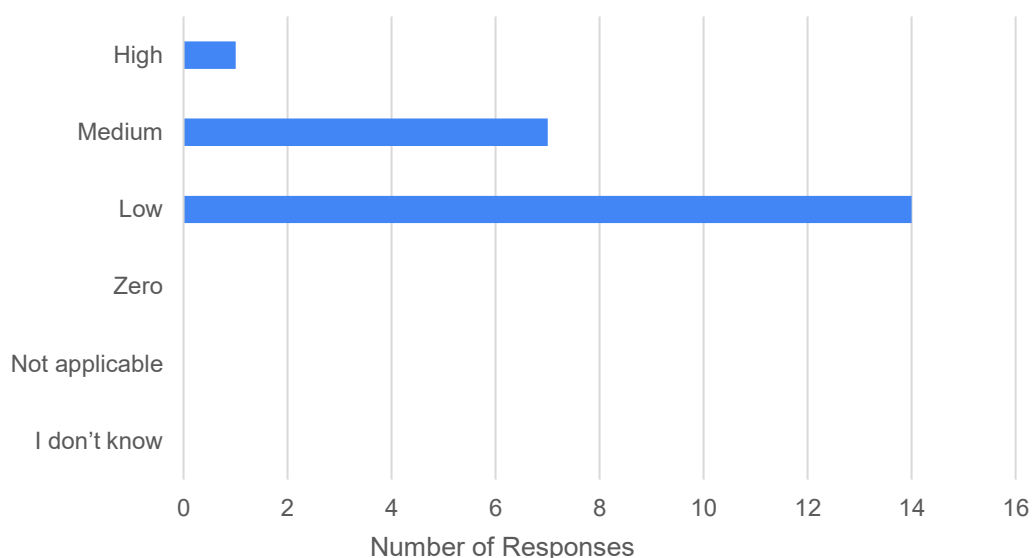
### *Individual Questions*

95. In your opinion, how would you describe the level of public awareness regarding pollution impacts in your country's coastal waters? (Choose one)

Most respondents (14) perceive a low level of public awareness regarding pollution impacts in your country's coastal waters, while others perceive a medium level of public awareness (7) and just one perceives a high level of public awareness.



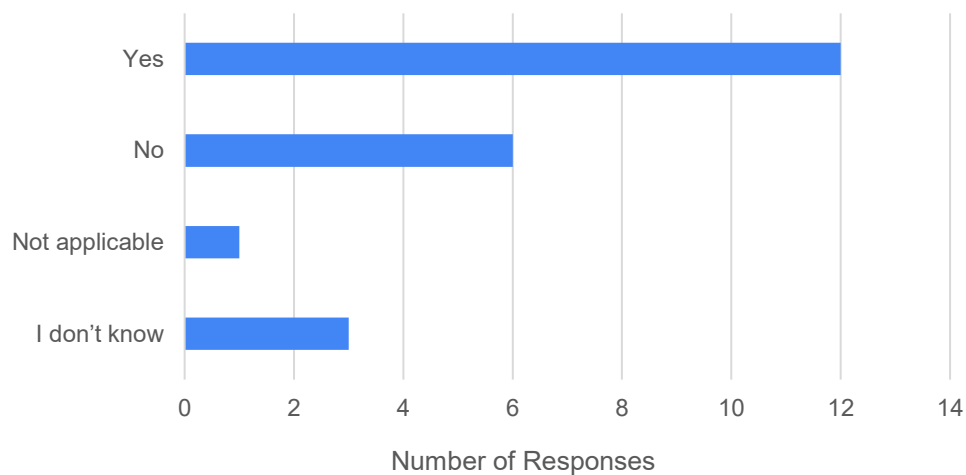
### Public Awareness Level on Pollution Impacts



96. Does your country's coastal water quality monitoring program participate in any engagement activities (e.g. public workshops, campaigns, school programs) to build knowledge in the general public? (Choose one)

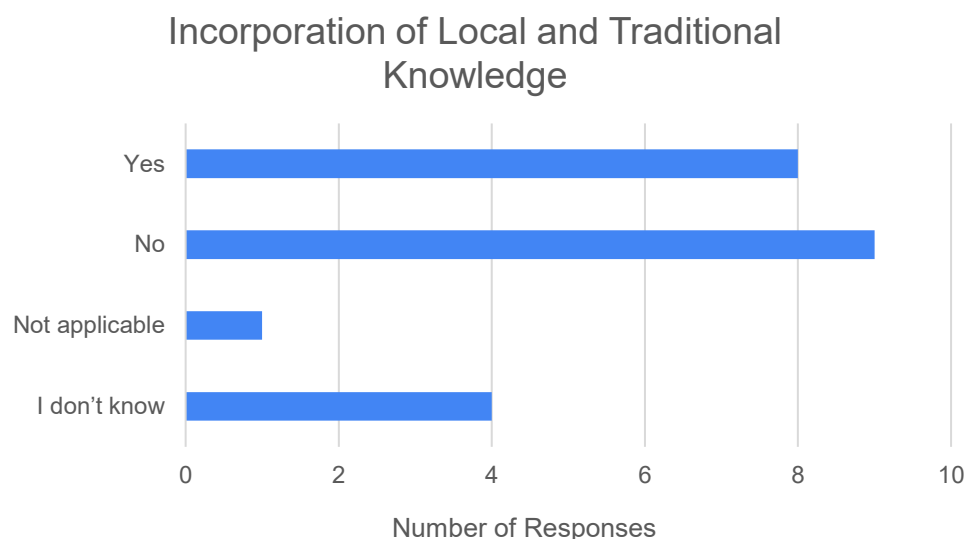
12 of the surveyed respondents stated their country's coastal water quality monitoring program participates in engagement activities to build public knowledge.

### Participation in Engagement Activities



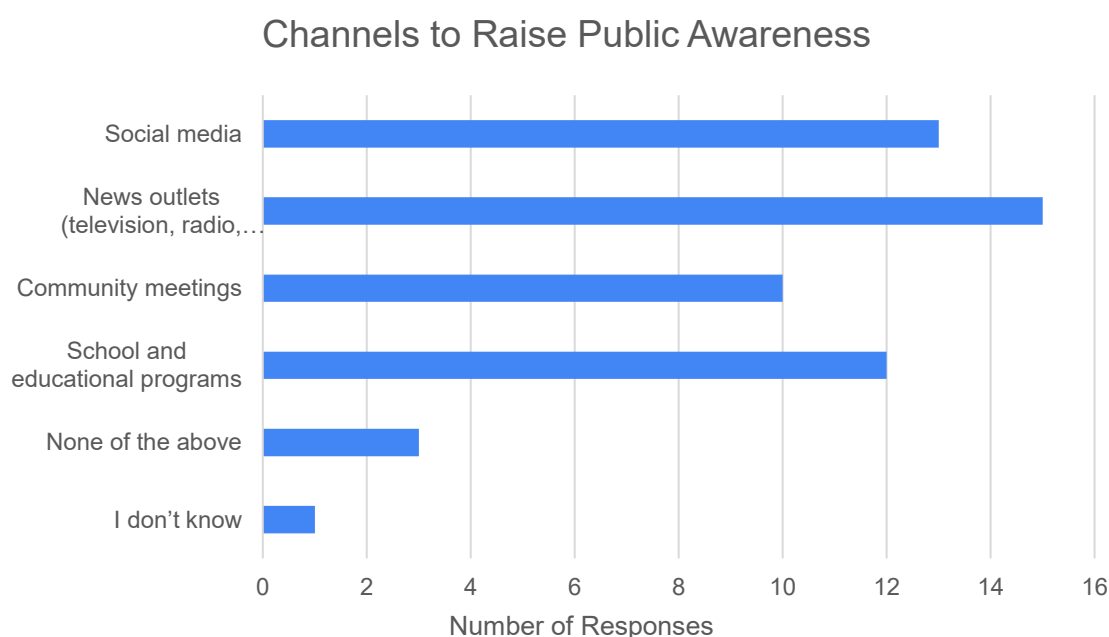
97. Is local and traditional knowledge incorporated into any activities of your country's coastal water quality monitoring program? (Choose one)

Local and traditional knowledge is incorporated into activities of just eight of the surveyed countries' coastal water quality monitoring programs.



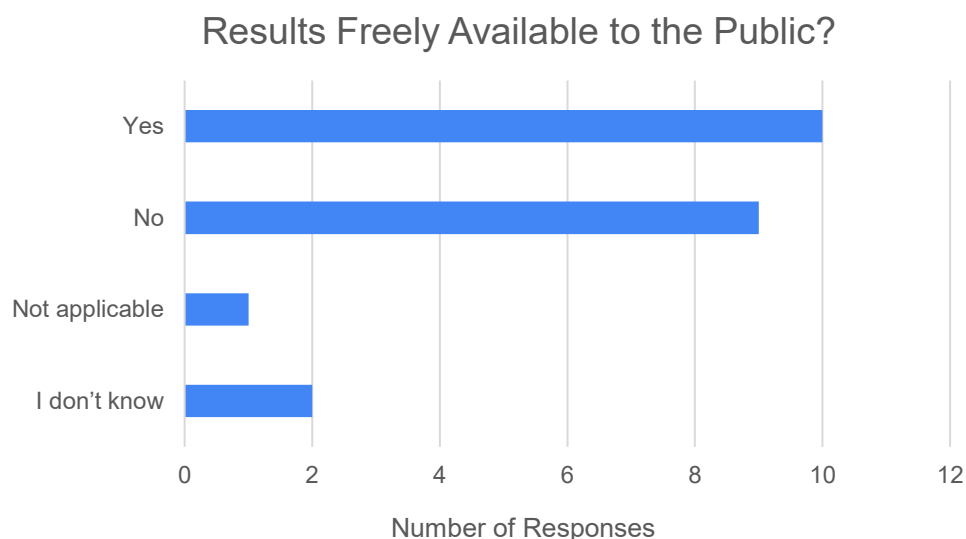
98. Which of the following channels are most commonly used to raise public awareness about coastal water quality issues in your country? (Choose all that apply)

The following channels are used to raise public awareness about coastal water quality issues in the surveyed countries: news outlets (15), social media (13), school and educational programs (12), and community meetings (10).



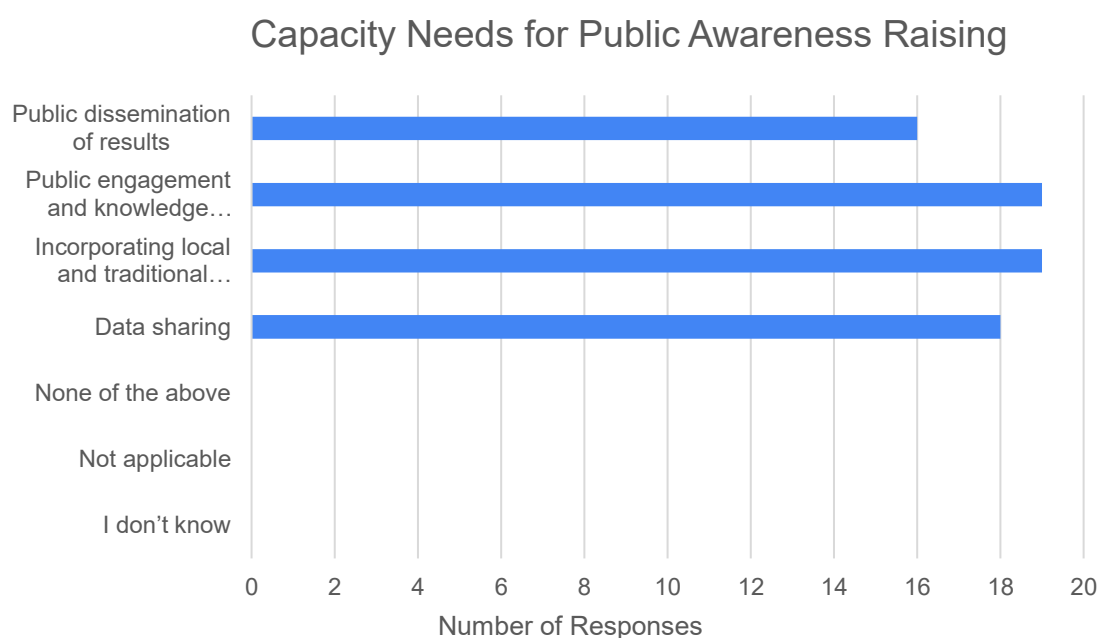
99. Are the results of your country's coastal water quality monitoring program made freely available to the public? (Choose one)

The results of just 10 of the 22 surveyed countries' coastal water quality monitoring programs are made freely available to the public.



100. In your opinion, which aspects of public awareness raising could your country's coastal water quality monitoring program benefit most from capacity development? (Choose all that apply)

Most respondents expressed interest in capacity development in the following aspects of public awareness raising: incorporating local and traditional knowledge (19), public engagement and knowledge building (19), data sharing (18), and public dissemination (16).



101. Do you have any additional thoughts or recommendations regarding capacity gaps and challenges regarding public awareness raising related to your country's coastal water quality monitoring program? (Open text response)

Responses included the following additional thoughts or recommendations:

- Limited public awareness can lead to budget limitations for monitoring campaigns and the acquisition of supplies and equipment, as well as training of human resources.
- Implementing awareness programs for the population on the protection of natural resources would be recommended.

## **Section 13: Gender**

### *Summary*

Few respondents confirmed that their country's water resource management framework includes provisions for gender-specific livelihood impacts, whether explicitly in national policies (5), indirectly (3), or in regional/local policies (1).

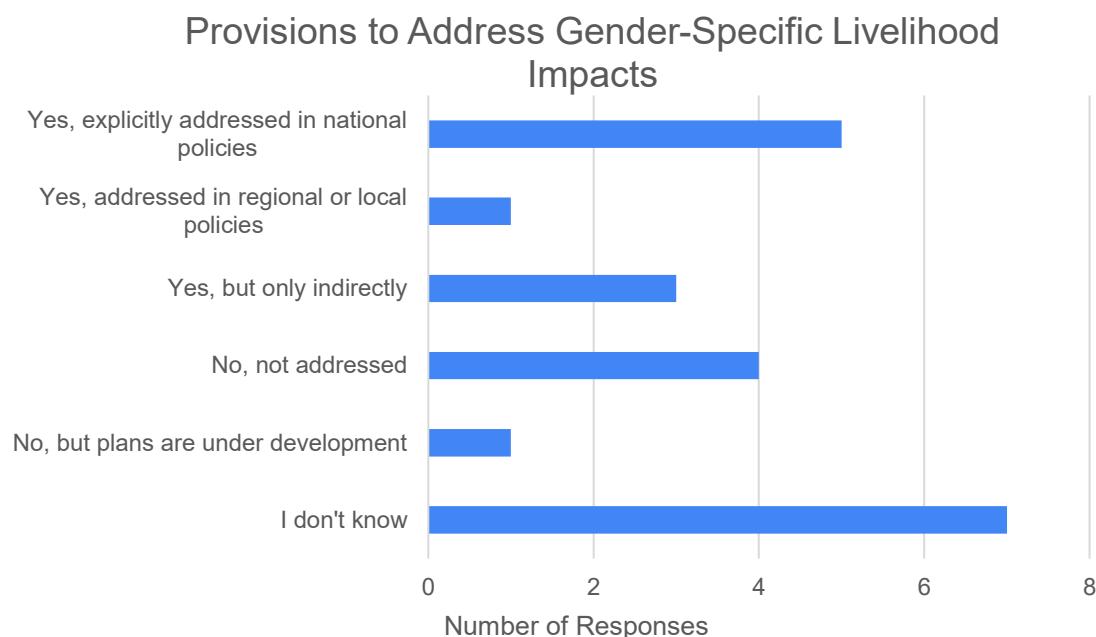
Only three countries collect and report gender-disaggregated data on water pollution's livelihood impacts, either routinely for national reports (2) or for specific projects/regions (1).

Targeted support for women in water quality processes varies, with some countries having national programs for women and marginalized groups (7), regional/local programs (5), or limited support (7).

### *Individual Questions*

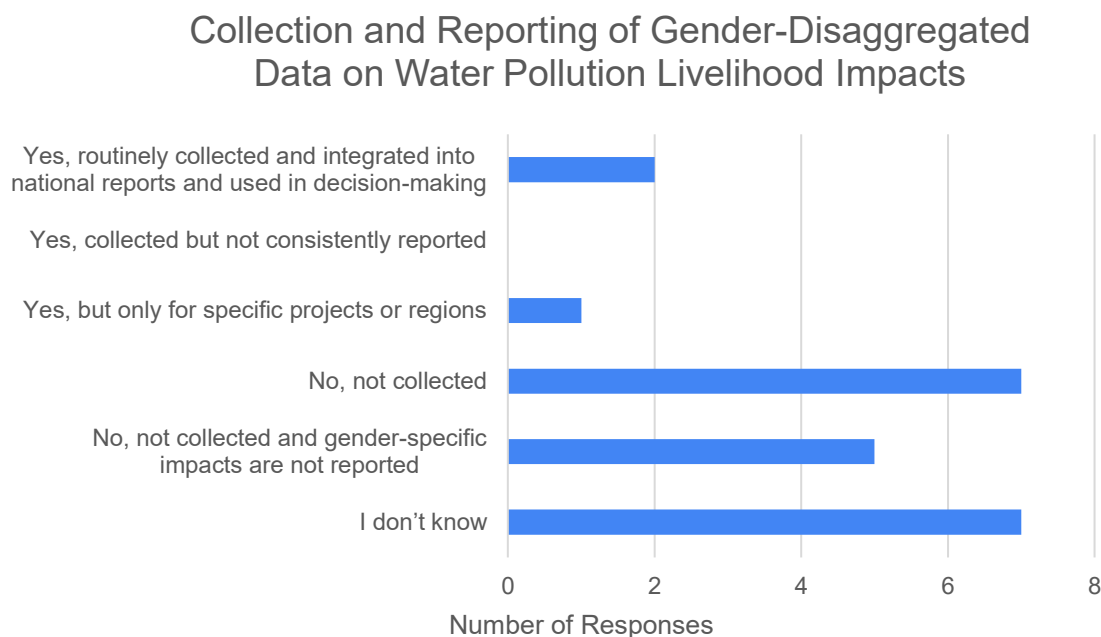
102. Does your country's water resource management framework include provisions to address gender-specific livelihood impacts (e.g., policies supporting women in water-dependent sectors such as agriculture, fisheries, or tourism)? (Choose one)

Relatively few respondents confirmed that their country's water resource management framework include provisions to address gender-specific livelihood impacts, either explicitly in national policies (5), indirectly (3) or in regional or local policies (1).



103. Does your country's water quality monitoring program collect and report gender-disaggregated data on the livelihood impacts of water pollution (e.g., reduced income from fisheries or farming due to poor water quality)? (Choose one)

Only three respondents confirmed that their country's water quality monitoring program collects and reports gender-disaggregated data on the livelihood impacts of water pollution, either routinely for national reports and used in decision-making (2) or for specific projects or regions (1).



104. Are women from diverse backgrounds provided targeted support for capacity development for participation in water quality processes and to enhance their

knowledge in water-dependent sectors (e.g., through training in water quality monitoring or pollution control measures)? (Choose one)

Various respondents confirmed that women from diverse backgrounds are provided targeted support for capacity development for participation in water quality processes and to enhance their knowledge in water-dependent sectors. These include national programs that specifically target women and marginalized groups (7), regional or local programs target women and marginalized groups (5), while in seven cases this support is provided by limited in scope.

### Are Women from Diverse Backgrounds Provided Targeted Support for Capacity Development?

