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NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL

CONSULTATION TO UNDERTAKE A BASELINE STUDY, DEVELOP AN ACTION PLAN AND SUPPORT CAPA CITY BUILDING ON MICRO PLASTIC POLLUTION MONITORING IN THE NILE BASIN COUNTRIES

WATER RESOURCES MANAGEMENT SERIES

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Document Sheet

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The purpose of the technical report series is to support informed stakeholder dialogue and decision making in order to achieve sustainable socio-economic development through equitable utilization of, and benefit from, the shared Nile Basin water resources.

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Summary

The Nile Basin Initiative (NBI) aims to improve the current state of knowledge on plastic pollution in the Nile Basin, jointly with technical support from the GIZ-implemented “BMUV Support Project on Marine Litter Prevention”t, commissioned by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), as part of the "Marine Debris Framework – Regional hubs around the globe (Marine:DeFRAG)" programme .

Plastic pollution in oceans and freshwater systems is increasingly being recognized as a global environmental problem. Rivers play an important role in transporting plastic waste from land to the ocean, but they also serve as accumulation zones for plastic debris, creating long-term, secondary sources of plastic pollution. There is a need for better data on plastic pollution in rivers to identify hotspots and document trends in order to develop strategies and measures to effectively combat plastic pollution.

The objective of the Baseline Study is to assess current approaches used in the Nile Basin countries to monitor plastic pollution. It aims to identify relevant organisations across various sectors—government, civil society, academia, research institutions, and the private sector—and evaluate their gender-disaggregated capacities to implement systematic macroplastic monitoring programmes. The Baseline Study serves as the basis for the development of the Action Plan, which will be the final deliverable of the project.

A review of existing macroplastic monitoring methods found that the most commonly employed methods, both globally and within the Nile Basin, are simple, such as visual counting from bridges or bank surveys. Data on macroplastic pollution in the Nile Basin is sparse compared to other regions, although global data availability on macroplastics is also generally limited. Notably, there are currently no systematic macroplastic monitoring programmes operational in the Nile Basin or globally. Most macroplastic observations consist of sporadic measurements at limited locations and times, primarily for exploratory studies. In contrast, some clean-up initiatives have operated for multiple years, focusing on plastic collection rather than systematic monitoring. These initiatives often report the amount of plastic collected (by mass) but do not follow harmonized protocols for data collection. With harmonized methods for data collection and reporting, these activities could be integrated into systematic monitoring programmes.

The stakeholder mapping and analysis of resource and capacity potentials for macroplastic monitoring in the Nile Basin revealed both significant challenges and opportunities. A diverse stakeholder landscape was identified, encompassing 495 stakeholders from the public sector (104 stakeholder), private sector (27 stakeholder), academic sector (83 stakeholders), and civil society sector (213 stakeholders) across the Nile Basin countries as well as not further specified stakeholders. However, stakeholders are unevenly distributed across countries and sectors, with a particularly high number of stakeholders in the upper Nile Basin and within civil society organizations. The survey results highlighted several multidimensional capacity challenges with regard to macroplastic monitoring, in particular related to the enabling environment, the implementation capacity as well as challenges related to awareness and communication. Despite these challenges, the stakeholder mapping demonstrated significant potential. Nearly 75% of stakeholders are engaged in clean-up and/or monitoring activities.

The analysis showed that 75% of the survey respondents were male, while only 25% were female. The findings revealed no significant differences between male and female respondents in their perceptions of capacities, resources, and other factors related to macroplastic monitoring. Both genders provided similar assessments of the enabling environment, monitoring processes, and communication. There were only two notable differences: male respondents in academia and in Tanzania reported higher levels of information sharing than their female counterparts.

1 Background and Scope

The exponential growth of plastic production since the 1950s and inadequate waste management have resulted in the accumulation of plastic debris - from macroplastic objects to nanometer-sized particles - in the environment. The marine environment is a major sink for plastic debris, most of which is generated on land and transported from coasts and by rivers. The widespread occurrence of plastics in soils, lakes, rivers and the marine environment, combined with its longevity, makes it a global environmental threat (MacLeod et al. 2021).

While rivers are considered a major transport pathway for plastic from land to the marine environment, increased observational data indicates that substantial amounts of plastic debris accumulate in and around rivers. The accumulation of plastic debris in and around rivers and on land in general creates a legacy of plastic pollution, even if the primary leakage of mismanaged plastic waste has ended.

Reducing plastic pollution in both the marine and terrestrial environment requires a holistic approach addressing the different phases of product life cycles. This includes product design that uses less plastic, the reduction of single-use items, especially packaging, and design for recyclability. A key factor in reducing plastic leakage into the environment is improving waste management, including collection, sorting, recycling and disposal. Policy measures and societal engagement can support behavioural change, promote greater producer responsibility and introduce regulations on the use of plastics and waste management practices.

1.1 The need for plastic monitoring

All figures on plastic pollution have one thing common: uncertainty. Compared to other water quality parameters, data on plastics, in particular in freshwater environments, is still scarce. There is a need to monitor plastics in rivers to identify hotspots of plastic pollution and reveal temporal trends, to inform the development of measures to effectively combat plastic pollution, and to track the success of efforts to reduce plastic waste and clean up initiatives.

1.2 The project

Germany is committed to combating marine plastic litter supported by the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV). The “Marine Debris Framework – Regional hubs around the globe (Marine:DeFRAG)” funding programme supports developing countries and emerging economies to avoid marine litter and establish effective waste collection and recycling systems (https://www.z-u-g.org/en/marine-litter). One of those regional hubs is the Nile Basin where the Nile Basin Initiative (NBI) is committed to enhance the current level of understanding of plastic pollution transported by the Nile and its source areas in the catchment.

The Nile is considered to transport substantial amounts of plastic into the Mediterranean. However, plastic pollution also poses risks to human and ecosystem health in the Nile Basin. The first phase of the project on plastic pollution in the Nile Basin aimed at achieving a comprehensive understanding of the current extent of plastic pollution transported through the Nile Basin (Shesh et al. 2022). This analysis was conducted based on the analysis of waste streams and analysis of waste management practices. The second phase covered under this contract aims to understand and assess existing approaches to monitor

plastic in the Nile Basin, provide training on plastic monitoring and develop an Action Plan for the implementation of a plastic monitoring concept for the Nile Basin countries. The focus will be on macroplastics, as they contribute a substantial proportion of the total plastic pollution (in terms of mass) and can be monitored using simpler methods than are required for microplastics. This makes macroplastics an ideal starting point for the implementation of plastic pollution monitoring.

2 Review of Macroplastic Monitoring Methods and their application in the Nile Basin

The objective of this section is to provide a comprehensive portfolio of available methods for macroplastic monitoring and to review how those methods are applied worldwide in general and in particular in the Nile basin.

Our approach is to conduct a structured review of scientific publications and a broader review of reports and activities and projects of non-academic actors.

2.1 General overview on Macroplastic Monitoring methods

In general two types of methods can be distinguished (UNEP, 2021): Sampling-based methods and observational methods (Figure 2.1). Sampling-based methods for the water surface and water column typically rely on drift nets lowered from a boat, a bridge or a crane. Sampling can also be combined with activities to remove plastics which can be either manual or by using collection devices. Sampling enables, beyond the quantification of loads and concentrations, to analyse composition, polymer type, item type, size and mass distribution of the collected material. Observational methods collect information on the amount of floating macroplastics or on macroplastics accumulated on river banks. Counting floating macroplastics in rivers can be combined with information on streamflow which enables the quantification of macroplastic concentrations and loads. Using the same protocol across different rivers, consistent observations of floating plastic litter can be made in terms of time and space (van Calcar and van Emmerik 2019). In addition, observational methods provide ample opportunities for automatization and upscaling e.g. using bridge-mounted cameras, Uncrewed Aerial Vehicles (UAVs) and satellite imagery. Table 2.1 provides a general overview on methods for macroplastic monitoring. A comprehensive, critical review of methods used to measure macroplastic concentration and loads in rivers is provided in Hurley et al. (2023).

Table 2.1. Overview of existing Methods for Macroplastic Monitoring

Method	Compartment	Information	Application
Sampling-based methods			
(Drift) net	Water surface, Water column	**Mass**: Total mass of macroplastics collected. **Count:** Number of macroplastic items collected. **Loads:** Mass or items per unit time, considering river discharge. **Further Analysis:** Polymer type identification using spectroscopy techniques (e.g., FTIR, Raman).	Widely applied in riverine and marine studies, Integration with Microplastic sampling. One example is a longitudinal of the survey of the Danube in Austria (https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0551.pdf)
Manual collection	Water surface, Water column (both in smaller rivers), Riverbank		Widely applied, also combined with clean-ups , an example project is Plastic Pirates (https://www.plastic-pirates.eu)
Litter collection devices	Water surface, Water column	**Mass** of total litter and particulate material (e.g. Macrophytes) Derivation of macroplastic mass and count after sorting	Applied at a few locations worldwide, potentially high visibility, e.g. Mr. Trashwheel (https://www.mrtrashwheel.com)
Visual methods			
Visual counting	Water surface	**Mass**: item to mass conversation required (e.g. average mass per item) **Count:** Number of macroplastic items collected. **Loads:** items per unit time, considering river discharge.	Applied in multiple case studies (at least> 30 sites globally). Example: Odaw River (Ghana), Rhine (Germany, Netherlands), Mekong (Cambodia); (https://www.sciencedirect.com/science/article/pii/S0025326X23009372)
Fixed cameras on bridge imagery	Water surface		Test applications at several locations.No routine monitoring yet. Example: https://theoceancleanup.com/updates/a-tale-of-3-rivers-intercontinental-river-research-collaboration/
Bank surveys	Riverbank	**Count:** items present on river banks **Mass**: When collected or combined with cleanup	Widely applied, also combined with clean-ups
Unmanned Aerial Vehicle (UAV) imagery	Water surface, River Bank	**Count**: items detected on water surface and banj	Experimental application of UAV for beach surveys and survey of the water surface, no routine application so far. For application examples see also:

			https://www.giz.de/de/downloads/giz-2023-en-advances-in-remote-sensing-of-plastic-waste.pdf
Satellite imagery	Water surface, River bank	Method suitable if large items are present in the water or the bank or cluster of items form	Research application, more widely applied in marine and coastal setting. For application examples see also: https://www.giz.de/de/downloads/giz-2023-en-advances-in-remote-sensing-of-plastic-waste.pdf

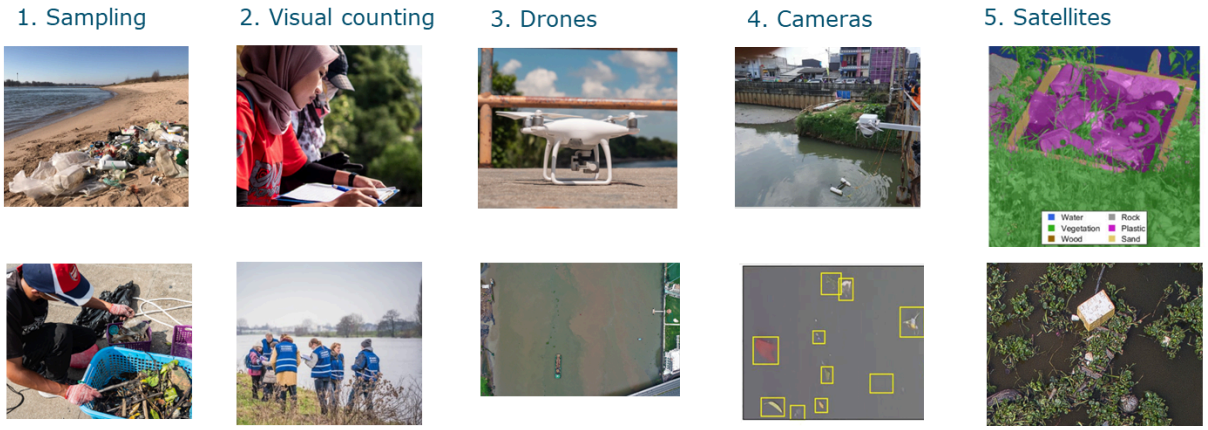

Figure 2.1. Illustration of the various methods for macro plastic monitoring.

Sampling

For sampling from the water surface and water column, mostly drift nets are used to collect the sample. Nets are typically lowered from bridges or attached to boats. In smaller rivers, where it is safe to wade, handheld nets can be used. Sampling provides various opportunities to further analyse the sample such as for composition, polymer type, item type, size and mass distribution. To sample macroplastics from river banks, similar to beach sampling, manual sampling can be used. The sampling can be combined with clean-ups. This would enable synergies in such a way that instead of only removing plastics, information on the number, mass, types of items etc. can simply be collected alongside with the clean-up.

Visual counting

Visual counting is a simple means of monitoring plastics. It can be used to quantify macroplastic transport (i.e. items per time) at a cross-section of a river by visual counting from a bridge. For larger rivers, the cross-section can be divided into subsections and the counting is performed by multiple observers.

Bridge, UAV and Satellite imagery

Imaging techniques are currently an emerging set of tools for macroplastic monitoring, enabled by imaging platforms (bridge-mounted cameras, UAV and satellites) and automated machine learning and artificial intelligence methods that allow the processing of large amounts of image data to recognise plastic items (e.g. van Lieshout et al. 2020). A comprehensive overview of the application of remote sensing is provided in (GIZ, 2023).

2.2. Methods applied for the review

To achieve an in-depth analysis of which macroplastic monitoring methods are applied where, we conducted a review of peer-reviewed scientific papers. We used the "Web of Science" platform to search for scientific papers related to macroplastic. We intentionally used a broad search to avoid the unintentional exclusions of relevant studies. We searched for the term "macroplastic*" which captures both the use of the term "macroplastic" and "macroplastics"in titles, keywords and abstracts. Our search on 14 October 2024 revealed 700 papers. Those papers have then been further processed to extract

those which involved the observation of macroplastic in rivers and lakes. In other words, we excluded studies that focus on pure method development in controlled experiments. Overall, 70 studies covered macroplastic observation applying 11 different methods. A complete list of the 70 studies is provided in Table A2.1.

In addition to scientific literature, we have reviewed existing guidelines and protocols which include macroplastic monitoring. By using a web search, we also aimed at identifying non-academic initiatives and organisations that are active in monitoring macroplastics.

2.3. Results of the Review

2.3.1. Scientific studies

Figure 2.1 shows the relative frequencies of the applied methods in the copus of studies. Observational methods such as riverbank surveys and visual counting of macroplastics on the river surface are applied in more than 50% of the studies. Riverbank surveys provide information on the abundance of macroplastic along the river. Visual counting, typically from bridges, provides information on macroplastics at the water surface. When combined with information of river discharge information on macroplastic load (items per time) can be obtained. About 30 % of the studies applied sampling based methods using various types of drift nets, manual sampling or evaluating the macroplastic items from collection devices. Sampling-based methods allow for a further classification of sampled macroplastic into product categories (e.g. bottles) and also polymer type. Collection devices often combine the interception of plastic transport in rivers with gathering of information on how much is transported.

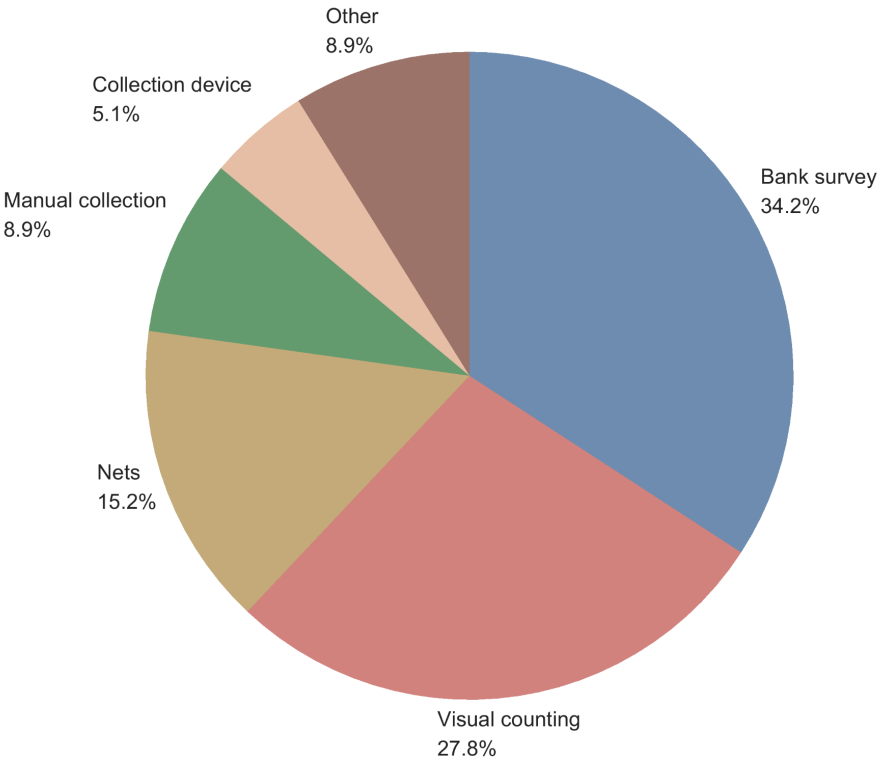

Figure 2.2. Relative frequency of macroplastic monitoring method applications

Table 2.2: Overview of Method Utilisation

Method	Compartment	Number of studies	Comment
Bank surveys	Riverbank	27	Bank surveys included the banks but also riparian vegetation that has trapped macroplastic items
Visual counting	Water surface	22	Applied in the Nile Basin, Amazon River Basin
Nets	Water surface, Water column	12	Applied in the Nile Basin, Mississippi River Basin
Manual collection	Water surface, Water column	7	Involved manual collection of macroplastic items from the water surface and the water column from boat or by wading

Collection device	Water surface, Water column	4	One example is Mr. Trashwheel (https://www.mrtrashwheel.com/)
Fixed Camera	Water surface	2	Mostly bridge mounted, automatized version of visual counting
Uncrewed Aerial Vehicle survey	Water surface	1	
Acoustic sounding	Water surface, Water column	1	
Indirect estimate	Water column	1	Based on the sampling of microplastic, macroplastic loads were estimated from relationships between micro- and macroplastic from other studies.
Sediment sampling	River sediment	1	
Urban area survey	River catchment	1	Abundance of Macroplastic has been assessed in Urban areas around the studied river, not only at the banks itself

2.3.2 Methods used by NGOs

NGOs and other initiatives are particularly active in addressing plastic pollution due to its visibility, ubiquity, and tangible impacts. Plastic pollution symbolizes broader systemic issues of overconsumption and unsustainable resource use. Moreover, it represents a direct connection between consumption and waste generation with environmental impacts, making it a relatable and solvable issue through advocacy, cleanup efforts, and education.

Multiple NGOs and other initiatives are active in different regions in collecting litter from river water and river banks. Collection is performed using collection devices (e.g. Mr Trashwheel and The Ocean Clean up interceptor). At lakes (for example Uganda Junior rangers) and larger rivers (e.g. Nile close to Cairo) collection of macroplastics is performed by engaging with local communities such as fishermen and women. The collected macroplastics are weighed or counted which serves as a performance metric

for the NGOs. Thus, the methods used by the collection and clean up initiatives can be categorized as sampling, either by collection devices or manually.

Some NGOs are active in Africa and in the Nile Basin but currently not in all Nile Basin countries. Below we provide some examples of NGOs which are active in plastic collection and (potentially) monitoring.

Egypt: The NGO the "VeryNile" partners with fishermen and women to collect floating macroplastics from the Nile in the Cairo region (https://verynile.org/).

Uganda: As one of the projects of the One Earth One Ocean (OEOO) initiative, the Uganda Junior Rangers (https://oneearth-oneocean.com/en/our-projects/oeoo-in-uganda) collect macroplastic from Lake Victoria in the Kampala and Greater Kampala Metropolitan region. They also partner with fishermen and women to collect ghost fishing gears.

2.3.3. Existing guidelines and protocols for macroplastic monitoring

There are several guidelines and protocols with recommendations for the choice of methods for plastic monitoring in general which also specifically address macroplastics.

The **UNEP Guidelines for monitoring plastics in Rivers and lakes (UNEP, 2021)** cover the entire size range of plastics ranging from Macroplastics to Micro and Nanoplastics. The guidelines recommend applying simpler, cost effective methods such as visual counting, as those lower the barriers to implement a sustainable long term monitoring as the requirements regarding infrastructure for sample processing and analysis are low. Simple approaches also could leverage the participation of citizen scientists including youth and women organizations. In addition, the guidelines recommend aligning locations with other water quality and hydrological monitoring activities to create synergies regarding already available data (e.g. river discharge) and an efficient use of resources (e.g. travel costs).

The **RIMMEL project (Riverine and Marine floating macro litter Monitoring and Modelling of Environmental Loading)** was an initiative by the European Commission's Joint Research Centre (JRC) aimed at quantifying the amount of floating macro litter, primarily plastic waste, entering European seas through river systems. Data was collected over a period of one year (September 2016 – September 2017) by visual observations and documented with the JRC Floating Litter Monitoring Application for mobile devices, allowing a harmonized reporting. There is no information on the current operational status of the app. The project provided recommendations for riverine litter monitoring (Gonzales et al. 2016), promoting visual counting as a cost-effective method for implementing a monitoring programme.

The **Riverine Plastic Monitoring in the Mekong River Basin** is an initiative similar to the one of the NBI. The Mekong River Commission (MRC) is involved in developing strategies for plastic monitoring, the so called MRC riverine plastic debris pollution monitoring programme (MRC, 2023), which is also supported by GIZ. The envisioned monitoring programme covers all sizes of plastic debris. Protocols have been developed for the monitoring of micro- and macroplastics. The protocol for monitoring macroplastics (MRC, 2023) suggests focusing on the evaluation of macroplastics that are captured during fishing activities, on visual counting of accumulated material and on net sampling from boats. The methods proposed in the protocol focus on the lower Mekong and are thus intended to be applied to a very large river.

2.3.4 Observations or Monitoring?

To date macroplastic observations are available across many regions of the world (Figure 2.3). Overall, the scientific papers covered 34 countries. Most studies are available in Europe and Asia. From Africa, studies have been conducted in Ghana, Kenya, South Africa, Tanzania and Uganda. These observations typically involve sporadic measurements taken at limited locations and times, often for exploratory studies. While useful for identifying the presence and extent of a problem, observations lack the systematic rigor needed to identify trends or support regulatory frameworks. A systematic monitoring with long-term collection of data at regular intervals and across multiple locations is not reported in the scientific literature. Interestingly, collection and clean-up initiatives have often operated over multiple years. However, their focus is on collecting plastics not on monitoring. They often report the amount (mass) of plastic collected but do not use harmonised protocols to also collect for example the essential meta data such as date and time of collection as well as stream flow or weather conditions (wet vs dry). At the time of the report preparation, the authors of the report are not aware that operational plastic monitoring programmes neither in the Nile basin nor in other parts of the world exist that are performed with consistent methods over several locations with long term repetitions.

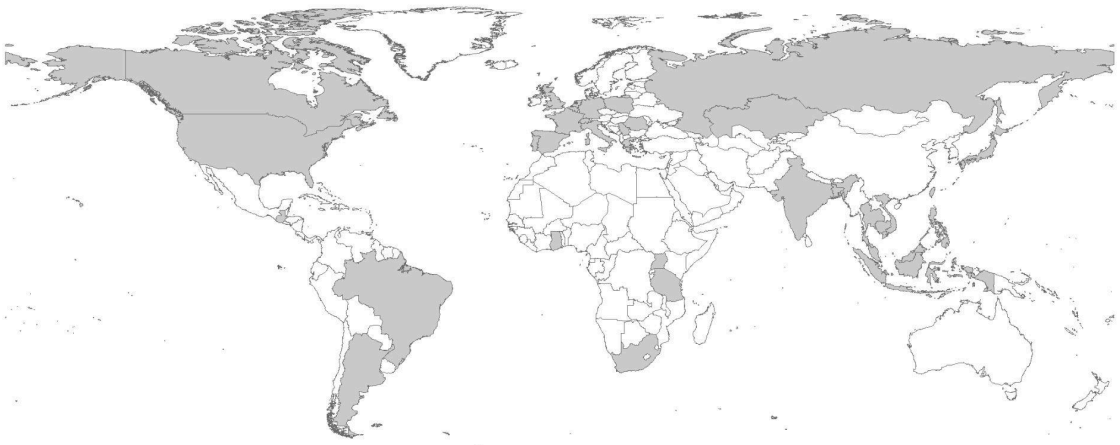

Figure 2.3: Global map showing countries (in grey) where scientific studies have been conducted on macroplastic pollution in rivers and lakes

2.3 Summary of the review of methods

The review of scientific literature, existing guidelines and protocols for macroplastic monitoring and the work of NGOs involved in plastic clean ups (and in monitoring) reveals clear patterns: simpler methods such as visual counting, bank survey, and sample collection by nets, collection devices or (in smaller

rivers and streams) manually dominate by far over more technical approaches such as fixed cameras or drone surveys. Visual counting, bank surveys and sampling by using nets are the top 3 methods applied.

The analysis also showed that monitoring performed in the frame of scientific projects is mostly limited to a fixed time period with often only a few replications. Thus, the existing studies and approaches cannot be considered systematic monitoring in a stricter sense but provide snapshots in time.

3 Assessment of Capacities and Resources

3.1 Stakeholder mapping

In this section we analyse the potential for plastic monitoring based on a comprehensive stakeholder analysis and survey on capacity challenges regarding plastic monitoring. Results show that there is high potential for joint action, given the high number of about 500 stakeholders from the public, private, academic, and civil society sector in the 10 Nile riparian states. At the same time, challenges are high and include deficiencies with respect to the enabling environment, the actual data collection, handling, and evaluation, as well as the communication amongst the stakeholders both within and across countries. While little gender differences exist regarding these challenges, the study mainly identified male actors, hinting to important biases in the stakeholder landscape. The results call for action to lift the high potential in plastic monitoring to joint monitoring action in the Nile basin. The Nile basin initiative, along with key stakeholders from the four stakeholder groups and countries, is encouraged to champion this effort in the future as part of its mission to support information transfer in the basin.

3.1.1 Tasks

An overview of stakeholders and initiatives on plastic monitoring and environmental action related to macroplastics across the basin, as well as their activities, was created. It included actors and initiatives from the public sector, private sector, civil society, and academia (quadruple helix) across the basin. Special emphasis was placed on actors and initiatives from civil society, including international and national NGOs and women's initiatives. The stakeholder mapping considered gender categories and, where applicable, additional diversity categories such as youth. The map was based on a keyword search of scientific literature (SCOPUS or Web of Science) and grey literature on websites (Google research). It was further expanded through snowballing via email requests and/or short conversations with key stakeholders.

Potential types of stakeholders

The analysis considered four key actor groups within the quadruple helix, including the public sector, civil society, the private sector, academia, and boundary organizations, as well as respective sub-groups within all riparian states of the Nile Basin.

Public authorities

- National Environmental Agencies
- Water Management Authorities

- NBI Experts
- Experts on water quality and hydrological monitoring (with or without expertise in plastics monitoring so far)

NGOs/Civil Society Organizations

NGOs/CSOs active with the Nile Basin countries in plastic monitoring and/or cleanup activities (including the Nile Basin Discourse; https://www.nilebasindiscourse.org)

- Citizen Science/ Citizen engagement initiatives that are active/ interested in plastic monitoring
- Women's Organisations: Addressing gender-specific impacts and promoting female participation in environmental initiatives

Academia and Research Institutions

- Universities/research organisations involved in projects on plastic monitoring in the Nile Basin

Private Sector

- Waste Management Companies: Involved in recycling and waste disposal
- Corporate Social Responsibility (CSR) Initiatives: From companies aiming to reduce plastic waste

3.1.2. Specific Methods applied

The actual stakeholder analysis included three consecutive steps:

Step 1: Research on Scopus

In a first step, we implemented systematic literature research for academia including both universities and non-university research institutes. To this end, we implemented a title-abstract-keyword search on Scopus using a combination of keywords including different water types, plastic, and the different Nile riparian states. The keyword combination is as follows: "TITLE-ABS-KEY ((water OR freshwater OR groundwater OR river OR aquifer OR surface-water OR drinking-water) AND (plastic*) AND (respective country))".

Scopus allows for additional specifications of search strings, which were applied as follows: First, the search was further refined by focusing on articles that were published between 2007 and 2024). This starting date in 2007 was chosen as publications significantly increased after 2007 and as stakeholders that are still active in the field would be preferable. Second, the subject areas were limited to relevant areas, if a high number of publications occurred. These subject areas are 'environmental science', 'engineering'; 'material science', 'agriculture and biological science', 'social science', 'nosiness', 'Biochemistry', 'Genetics and Molecular Biology', 'Chemistry; Business', 'Management and Accounting', and 'Multidisciplinary'.

The key word search revealed a total of 403 publications with potentially relevant articles written by potentially relevant stakeholders. However, an additional screening based on title, abstract and keywords revealed that only a small number of these publications showed strong links to plastic pollution in the Nile Basin.

In addition to this systematic approach, a fuzzier search on additional search platforms such as google scholar has been applied using the same key words, which revealed additional potentially relevant articles. These articles have been added to the list of potentially relevant articles.

As a result, 34 articles were identified as being relevant for the subject areas of this research. These 34 publications were the basis for identifying key academic stakeholders related to plastic in the Nile basin. The academic stakeholders of these publications include authors and co-authors, if their contact information and affiliation could be detected.

Table 3.1 shows the results of this keyword search, structuring the results along the riparian countries of the Nile basin.

Table 3.1. Literature research related to water, plastic, and the Nile basin. A complete reference list of the selected publications is provided in Annex 3.1.

Country	Refined search by subject areas	Number of publications	Selected publications
Burundi	-	0	0
Congo	Subject area: Environmental Science, Agricultural and Biological Sciences, Earth and Planetary Sciences, Engineering, Materials Science, Chemistry, Chemical Engineering, Social Sciences, Business, Management and Accounting	48	1
Egypt	Subject area: Environmental Science, Agricultural and Biological Sciences, Earth and Planetary Sciences, Engineering, Materials Science, Chemistry, Chemical Engineering, Social Sciences, Business, Management and Accounting	123	8
Ethiopia	Subject area: Environmental Science, Agricultural and Biological Sciences, Earth and Planetary Sciences, Engineering, Materials Science, Chemistry, Chemical Engineering, Social Sciences, Business, Management and Accounting	58	4

Kenya	Subject area: Environmental Science, Agricultural and Biological Sciences, Earth and Planetary Sciences, Engineering, Materials Science, Chemistry, Chemical Engineering, Social Sciences, Business, Management and Accounting	67	3
Rwanda	Subject area: Environmental Science, Agricultural and Biological Sciences, Earth and Planetary Sciences, Engineering, Materials Science, Chemistry, Chemical Engineering, Social Sciences, Business, Management and Accounting	2	1
South Sudan		2	1
Sudan	Subject area: Environmental Science, Agricultural and Biological Sciences, Earth and Planetary Sciences, Engineering, Materials Science, Chemistry, Chemical Engineering, Social Sciences, Business, Management and Accounting, Multidisciplinary	37	2
Tanzania	Subject area: Environmental Science, Agricultural and Biological Sciences, Earth and Planetary Sciences, Engineering, Materials Science, Chemistry, Chemical Engineering, Social Sciences, Business, Management and Accounting, Multidisciplinary	34	4
Uganda	N.A.	32	2
International	N.A.	0	3
TOTAL		403	29

Step 2: Research in the World Wide Web

In a second step, we searched for further types of stakeholders in the World Wide Web, using google search functions.

To this end, we used a combination of keywords including different water types, plastic, the different Nile riparian states, the Nile, and different types of stakeholders in the political administrative system, civil society, and the private sector (Table 3.2). For each search, keywords from column no. 1 and 2, in combination with one keyword from category no. 3 for each country was used, along with additional keywords specific to the respective group or sub-group. In cases where the search yielded a large volume of results, an additional refinement was applied by incorporating the keyword from columns no. 4 into the search query.

Table 3.2. Keywords (KW) used for stakeholder research on Google

KW 1	KW 2	KW 3	KW 4	Administrative and political stakeholders:	Civil Society	Private Sector
Water	plastic	Burundi	Nile	ministry	clean-up	
Freshwater	monitoring	(DR) Congo	"nile basin"	authority	"citizen science"	
Groundwater	"macro plastic"	Egypt		management	participatory	
Rivers	pollution	Ethiopia		politics	volunteer	
Aquifer	poly*	Kenya		administration	project	
Surface water	polyethilen	Rwanda				
Drinking water	PVC	"South Sudan"				
	synthetic	Sudan				
	debris	Tanzania				
		Uganda				

The search yielded results for all three categories. In the case of civil society, the focus was on identifying relevant projects related to plastic monitoring, water quality monitoring, plastic clean-up activities, citizen or participatory volunteer science, plastic reuse initiatives, and similar endeavors. Projects that had been recently completed or were still in progress were selected, and their contact information—sourced from project websites or corresponding project leaders—was incorporated into the final stakeholder list.

The language utilized on the website and the functionality of the website itself sometimes resulted in lacking accessibility to the team of authors. In some instances, access to the website was denied due to security concerns. Furthermore, in some cases, only telephone contact details are available, or relevant stakeholders are only active on social media platforms such as Facebook. This made the search for relevant stakeholders and email addresses in part challenging.

In sum, the Scopus and world wide web search methods applied in steps 1 and 2 resulted in the identification of 223 stakeholders.

Step 3: Feedback by local experts

In addition to the web search approaches, we contacted local experts to share their important information on key stakeholders in the basin. Two steps were particularly relevant.

- First, the Nile Basin District implemented an extensive stakeholder search in ten Nile riparian countries, resulting in 186 specified and another 42 not further specified civil society stakeholders.
- In addition, we asked the GIZ and Nile Basin Initiative to contact their regional contact points for additional stakeholders. To this end, national excel files were created and shared with GIZ on 30th of July, 2024. The respective lists were shared by the Nile Basin Initiative Secretariat with the Regional Water Quality Expert group. This procedure, however, did not result in additional stakeholders.
- The scoping mission in Uganda and Kenya in September 2024, resulted in 11 additional stakeholders (see also Section 3.3)
- In a survey on capacities and resources of stakeholders amongst the Nile riparian countries, we asked the participating stakeholders to share additional stakeholders related to plastic pollution in the Nile basin. This procedure resulted in 33 additional stakeholders.

3.1.3. Results Stakeholder Mapping

The analysis yielded a total of 495 relevant stakeholders. These stakeholders are detailed in a report "Mapping key CSO Actors in the plastic pollution monitoring in the Nile Basin Countries" (NBD, 2024) Figure 3.1 presents a summarized overview of results.

410 out of 495 (83 %) stakeholders were identified for the nine riparian states situated within the Nile catchment area. Most of the stakeholders related to the case of Uganda, with a total of 117 (24 %) stakeholders. Kenya and Egypt follow with 71 (14 %) and 48 (10%) stakeholders, respectively. In the Democratic Republic of Congo, a total of 34 (7%) stakeholders were identified, followed by Tanzania with 31 (6%) stakeholders, Burundi with 27 (5%), and Ethiopia with 25 (5%) stakeholders. South Sudan (22 stakeholders, 4%) and Sudan (17 stakeholders, 3%) have the lowest number of stakeholders. In addition, 39 (8%) of the relevant stakeholders have been identified as international stakeholders. Finally, forty-six (9%) of the identified contacts could not be assigned to a specific country.

Further, the analysis shows that most of the stakeholders identified are related to the civil society sector (213 stakeholders, 43,03 %). This is followed by stakeholders in the public sector (104 stakeholders, 21,01%), academia (83 stakeholders, 16,88 %), the private sector (27 stakeholders, 5,45 %), and sector boundary organization (4 stakeholders, 0,81 %) (Figure 3.1).

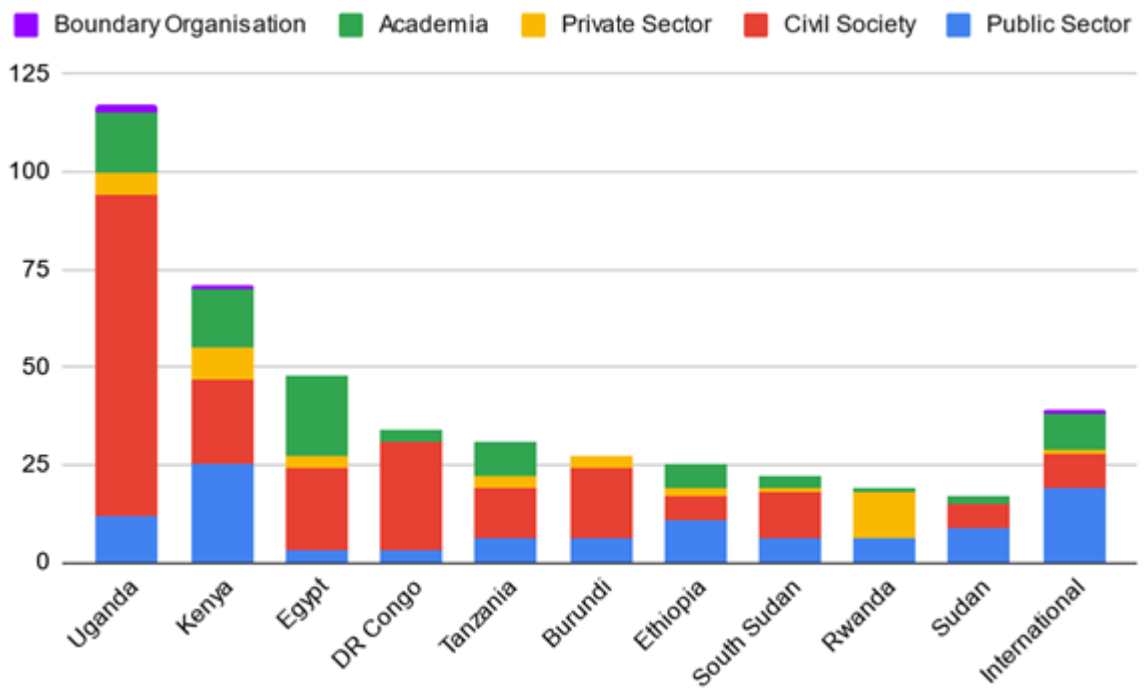

Figure 3.1. Overview of the distribution of the 449 (out of 495) stakeholders by country and sector. The remaining 46 stakeholders could not be assigned to a country.

Figure 3.2 shows how many stakeholders could be identified for each sub-group in the respective country. The colors refer to the number of actors for each sub-group, with green meaning that more than 5 actors exist, yellow meaning 1-5 actors exist, and red meaning 0 actors could be identified.

Category	Specific category	BDI	COD	EGY	ETH	KEN	RWA	SSD	SDN	TZA	UGA	INT
Public Sector	National authorities											
Public Sector	Local authorities											
Public Sector	Not further specified											
Civil Society	Plastic monitoring/Clean-up											
Civil Society	Other water monitoring											
Civil Society	Local organization											
Civil Society	NGO´s											
Civil Society	Women's organizations											

Civil Society	**Clean-up/awareness raising**											
Private Sector	**Waste management**											
Private Sector	**CSR**											
Private Sector	**Water management**											
Academia	**Universities**											
Academia	**Other research entities**											
Boundary orga.	**Media**											

Figure 3.2. Overview of number of stakeholders in the respective subgroups.

The following presents the respective results detailed for each riparian state of the Nile basin.

Burundi

Total number: In Burundi, a total of 27 stakeholders were identified belonging to 26 different organizations.

Stakeholder groups: Out of these 27 stakeholders, 18 stakeholders belong to civil society, 6 to the public sector and 3 to the private sector. No stakeholders could be identified in the academic sector or for boundary organizations.

Stakeholder sub-groups: Out of the 18 stakeholders in civil society, 14 stakeholders were identified as local organizations, 3 are involved in monitoring diverse aspects of water usage, and 1 stakeholder is engaged in monitoring the use of plastic. Out of the 6 stakeholders in the public sector, 3 national authorities were identified as stakeholders, while 3 could not be categorized with greater precision. Regarding the private sector, all three stakeholders are engaged in waste management activities.

Specific contacts and gender: Furthermore, a specific contact person was identified for 19 out of the 27 relevant stakeholders. Out of these 19 contact persons, 14 persons were male and five were female.

Democratic Republic of Congo

Total number: In the Democratic Republic of Congo, a total of 34 stakeholders were identified, belonging to 34 different organizations.

Stakeholder groups: Out of these 34 stakeholders, 28 stakeholders belong to civil society, 3 to the public sector and 3 to academia. No stakeholders could be identified in the private sector or for boundary organizations.

Stakeholder sub-groups: Out of the 28 actors identified within the civil society sector, 28 are non-governmental organizations (NGOs) of which 1 actor represents a women's organization. Regarding

the public sector, one actor could be assigned to the national authority, while no further precise allocation is possible for the other two actors. All three actors from academia belong to two different universities.

Specific contacts and gender: A specific contact person was identified for 31 out of the 33 relevant stakeholders. Out of these 31 contact persons, 23 persons were male and 8 were female.

Egypt

Total number: In Egypt, a total of 48 stakeholders were identified, belonging to 35 different organizations.

Stakeholder groups: Out of these 48 stakeholders, 21 stakeholders belong to the civil society sector, 21 stakeholders can be assigned to the academic sector, 3 belong to the public sector, and another 3 to the private sector. No stakeholders could be identified for boundary organizations.

Stakeholder sub-groups: In the civil society sector, 14 out of the 21 stakeholders are engaged in plastic monitoring, 6 in cleanup and awareness-raising initiatives, and 1 in other water monitoring activities. In the academic sphere, 8 of 21 stakeholders are from six different universities, with three stakeholders coming from the same university (Sohag University, Faculty of Science- Zoology Department) while 13 stakeholders are engaged with other research entities, namely the "National Institute of Oceanography and Fisheries, NIOF, Egypt". Regarding the 3 stakeholders in the public sector, one national authority could be identified, while two could not be further categorized. Regarding the 3 stakeholders in the private sector, one stakeholder is engaged in waste management, while two others are active in the domain of corporate social responsibility.

Specific contacts and gender: A contact person was identified for 38 of the 48 actors, of whom 22 were male and 16 were female.

Ethiopia

Total number: In Ethiopia, a total of 25 stakeholders was identified, belonging to 18 specified institutions and 1 unspecified organization.

Stakeholder groups: Out of the 25 stakeholders identified, 11 stakeholders come from the public sector, while 6 stakeholders are active in the civil society sector, another 6 in the academic sector, and 2 stakeholders work in the private sector.

Stakeholder sub-groups: Out of the 11 stakeholders active in the public sector, 7 stakeholders work in three different national agencies, of which the Ministry of Water and Energy was the most prominent with 5 stakeholders involved. The remaining 4 national stakeholders could not be classified further. Out of the 6 civil society actors, 4 were involved in clean-up and awareness raising activities (with 2 working for the same organization), while another 2 stakeholders are involved in plastics monitoring. 5 of the 6 academic actors work in universities (with two of them working in the same department at Jimma University), while 1 actor works for another research institution. In the private sector, 1 of 2 actors is involved in waste management and 1 in corporate social responsibility.

Specific contacts and gender: A total of 17 direct contacts were identified, of which 11 were male and six were female.

Kenya

Total number: In Kenya, a total of 71 stakeholders was identified, belonging to 60 specified institutions and 2 unspecified organizations.

Stakeholder groups: 25 of the 71 stakeholders work in the public sector, 22 in civil society, 15 in academia, 8 in the private sector, and 1 person in a boundary organization.

Stakeholder sub-groups: Out of the 25 stakeholders working in the public sector, 8 work in national authorities, 7 in local authorities, and 4 in international organizations. The 8 contacts for the national authorities are spread over three different institutions. Four of The 4 contacts in international organizations work for the Lake Victoria Basin Commission (LVBC) in Kenya. Further, it was not possible to specify 6 actors more precisely. In civil society, 17 of 22 identified stakeholders are involved in plastics monitoring and 2 in clean-up and awareness-raising activities. In addition, 2 actors are involved in citizen science and 1 in a women's organization. Out of the 15 actors from academia, 8 are connected to a university and 7 are employed in other research institutions. The 8 university contacts are spread over 4 different university institutions. Out of the 7 contacts working in other research institutions, 3 work at the Kenya Marine and Fisheries Research Institute (KMFRI). In the private sector, 5 out of 8 stakeholders are involved in waste management, 2 in water management, and 1 in corporate social responsibility. Finally, the actor within the boundary organizations works in the media.

Specific contacts and gender: A total of 54 contacts were identified, of whom 44 were male and 10 were female.

Rwanda

Total number: In Rwanda, a total of 19 stakeholders was identified, belonging to 15 different organizations.

Stakeholder groups: Out of the 19 stakeholders, 12 stakeholders are employed in the private sector, 6 in the public sector, and 1 in academia.

Stakeholder sub-groups: In the private sector, all stakeholders identified are involved in waste management. In addition, 5 out of 12 stakeholders are employed by Agruni Ltd, but in different locations within the country. Out of the 6 stakeholders in the public sector, 3 work at national authorities (of which 2 work for the same national authority) and 3 could not be specified further. In academia, the one stakeholder identified is employed at a university.

Specific contacts and gender: Of the 14 individuals identified as contacts, 12 are male and two are female.

South Sudan

Total number: In South Sudan, a total of 22 stakeholders were identified, belonging to 17 specified and 3 unspecified organizations.

Stakeholder groups: Out of the 22 stakeholders, 12 stakeholders are from civil society, 6 from the public sector, 3 from academia, and 1 from the private sector.

Stakeholder sub-groups: In civil society, 4 stakeholders are engaged in the monitoring of plastic usage, while 3 are involved in the remediation of environmental contamination and the dissemination of environmental awareness and 1 stakeholder is affiliated with a women's organization. The remaining four stakeholders could not be categorized more precisely. In the public sector, 3 national authorities were identified, whereas the remaining 3 stakeholders could not be specified further. In academia, the 3 academic contacts are employed at a university. In the private sector, the identified actor is engaged in waste management.

Specific contacts and gender: A total of 16 direct contacts were identified. Out of these, 13 were male and 3 were female.

Sudan

Total number: In Sudan, a total of 17 stakeholders were identified, belonging to 16 different organizations.

Stakeholder groups: Out of the 17 stakeholders in Sudan, 9 are employed in the public sector, 6 are engaged in civil society activities, and 2 are affiliated with academic institutions.

Stakeholder sub-groups: In the public sector, 4 national authorities were identified, amongst which the Ministry of Irrigation and Water Resources was the most prominent with 3 stakeholders working in this institution. Another 5 stakeholders could not be classified further due to insufficient information. In the civil society sector, 4 actors are engaged in the monitoring of plastic pollution, while two are involved in clean-up and awareness-raising activities. In the academic sector, one individual is employed at a university, while another 1 is affiliated with a non-university research institution.

Specific contacts and gender: Of the 12 total contacts, eight are male and four are female.

Tanzania

Total number: In Tanzania, a total of 31 relevant stakeholders were identified, belonging to 26 specified and 2 unspecified organizations.

Stakeholder groups: Out of these 31 stakeholders, 13 are engaged in civil society activities, 9 are affiliated with academic institutions, 6 stakeholders are employed in the public sector, and 3 stakeholders are employed in the private sector.

Stakeholder sub-groups: In the civil society sector, 6 stakeholders are involved in clean-ups and raising awareness, 5 actors are involved in monitoring plastic pollution, and 2 are engaged in promoting women's rights. In the academic sector, 6 stakeholders are affiliated with universities, spread over three different universities. Another 3 actors are associated with non-university research institutions, of

which 2 work at the Tanzania Fisheries Research Institute. In the public sector, 1 national authority and 1 relevant department were identified, while another 3 actors could not be specified further. One actor works for the international organization Lake Victoria Basin Commission (LVBC) in Tanzania. The 3 stakeholders in the private sector are involved in activities related to waste management, water management, and corporate social responsibility.

Specific contacts and gender: Of the 29 identified contacts, 19 are male and 10 are female.

Uganda

Total number: In Uganda, a total of 117 stakeholders were identified, belonging to 68 different organizations.

Stakeholder groups: The majority of these 117 stakeholders, 82 in total, represent civil society. Another 15 stakeholders come from academic institutions, 12 actors are situated within the public sector, 6 belong to the private sector, and 2 come from boundary organizations.

Stakeholder sub-groups: In the civil society sector, 34 stakeholders are involved in clean-up and awareness raising activities (of which 2 contacts for the Ecological Christian Organization, 2 contacts for A Rocha, and 5 contacts for Environmental Alert), 19 actors are involved in plastics monitoring, 6 belong to women's organizations, and 3 actors are involved in additional water monitoring activities. In addition, 20 actors could not be classified. Among the 20 actors that could not be further classified, 3 people work for the Climate Action Network Uganda and 2 people work for Regenerate Africa. In academia, 5 individuals are employed at three universities, while 10 are engaged in research activities at nine other organizations. In the public sector, 2 national authorities with five contacts were identified. In addition, 4 local authorities were identified, while three actors could not be further characterized. In the private sector, 4 individuals are engaged in waste management, and 1 stakeholder is involved in corporate social responsibility activities. Regarding boundary organizations, 1 actor is engaged in media work, while another 1 is involved in providing an exchange platform (forum).

Specific contacts and gender: A total of 82 contacts were identified, of whom 57 were male and 25 were female.

International

Total number: Internationally, a total of 39 stakeholders connected to the Nile basin were identified, belonging to 30 different organizations.

Stakeholder groups: Out of the 39 international actors, 23 are from the public sector, 9 are affiliated with academic institutions, 5 are from civil society, one can be classified as boundary organizations, and 1 comes from the private sector.

Stakeholder sub-groups: The 23 stakeholders within the public sector are divided into 18 different types of actors. 3 contacts belong to the Eastern Nile Technical Regional Office and 3 belong to the GIZ. 2 contacts each are distributed among 4 organizations: Nile Equatorial Lakes Subsidiary Action Program Coordination Unit, Lake Victoria Basin Commission, NBI Secretariat, Nile Basin Discourse and the

Global Water Partnership Eastern Africa. The other four contacts work in other organizations. In the academic sector, 7 individuals are associated with 6 different universities, while 2 are associated with other research institutions. In terms of civil society, 1 actor is involved in plastics monitoring, while 4 actors are involved in other water monitoring activities. In terms of boundary organizations, 1 actor is active in the media. The private sector actor is involved in waste management.

Specific contacts and gender: A contact person was identified for 29 of the 39 stakeholders. Of the identified contacts, 17 were male and 12 were female.

3.2. Analysis of capacities

3.2.1 Tasks

The analysis of capacities and resources includes the enabling environment for monitoring, the capacities and resources for the specific monitoring activities, as well as communication aspects that are typically of key importance in transboundary basins with a large number of countries:

- Enabling environment: This category refers to the governance of the monitoring process, including existence of responsible authorities, the existence of obligatory rules for monitoring, as well as the existence of monitoring strategies

- Monitoring process: The analysis examined three types of capacities and resources (technical equipment, human skills, and financial resources) across three phases of the monitoring process (monitoring, analytics, and analysis).

- Communication: This category refers to the communication aspects related to the monitoring process and specifically in particular points to the sharing of data and information between the different types of actors in society (academia, society, business, and politics).

These three overarching categories are considered key in a data-to-action approach aimed at evidence-informed decision making and implementation across the Nile Basin. The monitoring processes are here the focus to collect comparable data across the basin. The enabling environment ensures the implementation of these processes, whereas the communication aspect is particularly relevant to explore the cooperation potential to galvanize a broader coalition of actors around the topic of plastic pollution monitoring and environmental action. The three categories can further be understood as consecutive needs (from an enabling environment, via monitoring, towards communication), but also typically take place simultaneously (e.g., communications as a precondition for joint monitoring strategies, revision of strategies throughout the monitoring activity) (Figure 3.3).

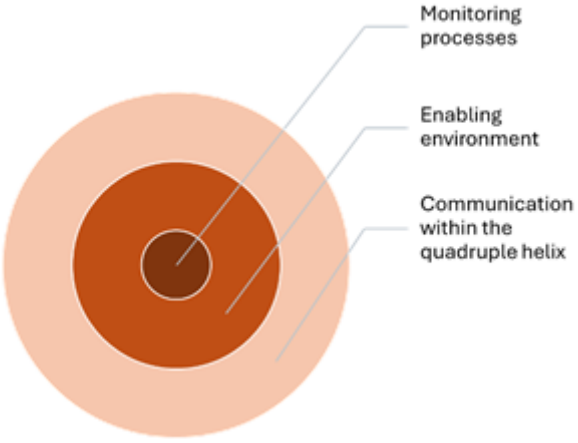

Figure 3.3 Three layers of capacity needs

The survey was co-designed and pre-tested with a team of experts. Within the survey, the final categories of capacities and resource needs were measured along a 4-point scale, from low to high levels each. The survey includes standard data of the respondents including gender to identify gender-specific needs, capacities, and resources needed. The survey has been implemented using a standard social science survey platform (e.g., SoSci) and distributed to all stakeholders identified based on the stakeholder analysis (see section stakeholder mapping and engagement).

3.2.2. Specific methods applied

Survey design and circulation

An online survey was designed based on the approach described in section 2.1. This included several steps:

Step 1: The specific survey design was first based on prior research in the field of plastic monitoring as published by Kirschke et al. (2020, 2023):

- Kirschke, S., Avellán, T., Bärlund, I., Bogardi, J. J., Carvalho, L., Chapman, D., Dickens, C, Irvine, K., Lee, S.-B., Mehner, T. & Warner, S. (2020). Capacity challenges in water quality monitoring: understanding the role of human development. *Environmental monitoring and assessment*, *192*, 1-16.
- Kirschke, S., van Emmerik, T. H., Nath, S., Schmidt, C., & Wendt-Potthoff, K. (2023). Barriers to plastic monitoring in freshwaters in the Global South. *Environmental Science & Policy*, *146*, 162-170.

This ensured the use of tested survey categories just as well as the comparability of parts of the results with other water quality parameters and countries.

Step 2: The survey categories were complemented by the respective needs for the context of the Nile basin, specifically questions regarding the role of communication. This included, in particular, questions related to the mutual awareness of stakeholders as information sharing amongst these stakeholders, including here both different stakeholder types (stakeholders from the public sector, private sector, civil society, and the private sector) as well as the 10 Nile riparian states. For both awareness and

information sharing, the survey asked about the so-called 'indegree' and 'outdegree' dimension. Indegree refers to how a survey respondent believes of how others see and act towards him or her; Outdegree refers to how the survey respondents believe how he or she sees and acts towards other stakeholders. This differentiation is particularly interesting as it can reveal different perceptions amongst stakeholders.

Step 3: The survey was pre-tested amongst a team of experts including different types of expertise such as plastic monitoring expertise, social network analysis, and regional expertise. In addition, we applied a formal survey check offered by GESIS Leibniz Institute for the Social Sciences, a leading research entity in the field of the social sciences. The feedback regarding contents and methods was collected based on the survey platform SoSci, allowing for both systematic and anonymous feedback. Based on the feedback, the survey was revised and finalized for online distribution via SoSci. This final English survey was translated into French to increase inclusivity. A PDF version of the survey in both English and French is provided in Annex 2 and 3.

The final survey was circulated amongst all stakeholders for which email addresses were provided, within a period of 5 weeks, between 21st of October 2024 and 25th of November 2024. As not all stakeholders have been known at the beginning of the study, the survey was calculated in three rounds: 1) the stakeholders identified based on web searches and based on the scoping mission; 2) additional civil society actors as provided by the Nile Basin District, and 3) the stakeholders mentioned as part of the online survey.

Analysis of survey data

The data of 128 completed surveys have been analyzed statistically, using both basic and advanced statistics.

With respect to descriptive statistics, we first calculated total numbers per answer category and percentages to receive an overview of the answers provided. We then calculated minimum and maximum values, lower and upper quartiles, and medians for all ordinal variables (1-4 answer categories). Based on these results, different figures were created such as bar charts, pie charts, and boxplots.

The results of step 1 revealed that many answers on capacities and resources provided on a 1-4 scale were rather similar. We therefore checked if the data can be reduced to underlying joint factors. To this end, a principal component analysis was implemented using SPSS software. Further, we checked if responses differ systematically between gender, implementing the Mann-Whitney-U test.

3.2.3. Results Capacity Assessment (surveys)

General information

In total, 128 stakeholders have completed the survey. Out of these 128 actors, 107 stakeholders completed the English version of the survey, and 21 stakeholders completed the French version. All stakeholders agreed to the declaration of consent.

Information on respondents

The answers of the respondents referred to all ten riparian states of the Nile basin as well as to other cases. About half of the answers referred to the cases Uganda (38 cases; 29.69%) and Kenya (28 cases; 21.88%); the other half referred to the Democratic Republic of Congo (11 cases; 8.59%), Burundi (9 cases; 7.03%), South Sudan (8 cases; 6.25%), Egypt, Ethiopia, and Sudan (each 7 cases and 5,47%), Tanzania (6 cases; 4.69%), and Rwanda (1 case; 0.78%), as well as other cases including Lake Victoria, EAC, NBI/NELSAP, Nigeria, all ten riparian states as well as one case that could not be translated adequately (6 cases, 4.69%) (Figure 3.4).

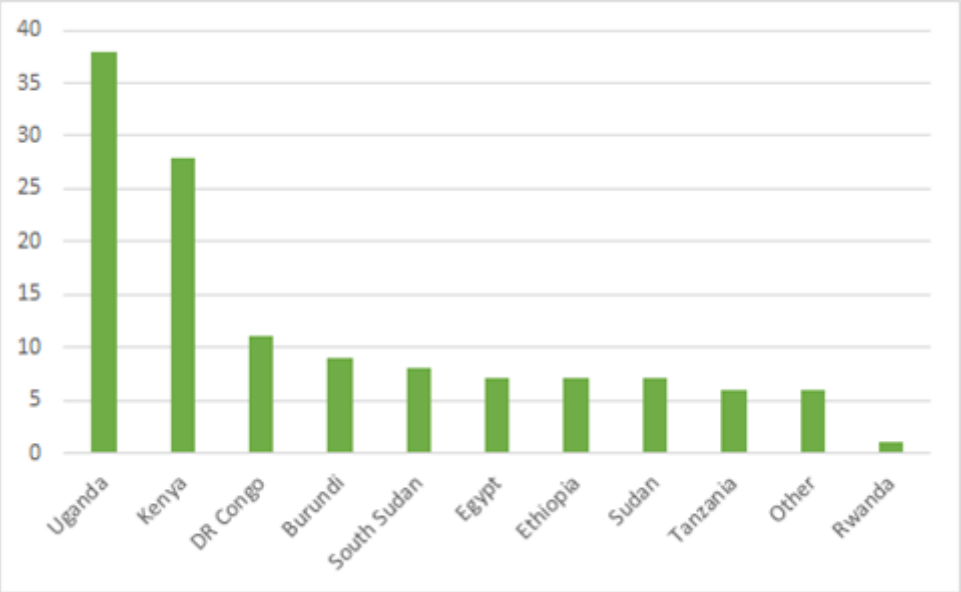

Figure 3.4. Countries represented in the survey.

Most of the respondents belong to the civil society sector (73 cases; 57.03%), followed by the public sector (26 cases; 20.31%), the private sector (13 cases; 10.16%), academia (13 cases; 10.16%), and boundary organizations (3 cases; 2.34%) (Figure 3.5).

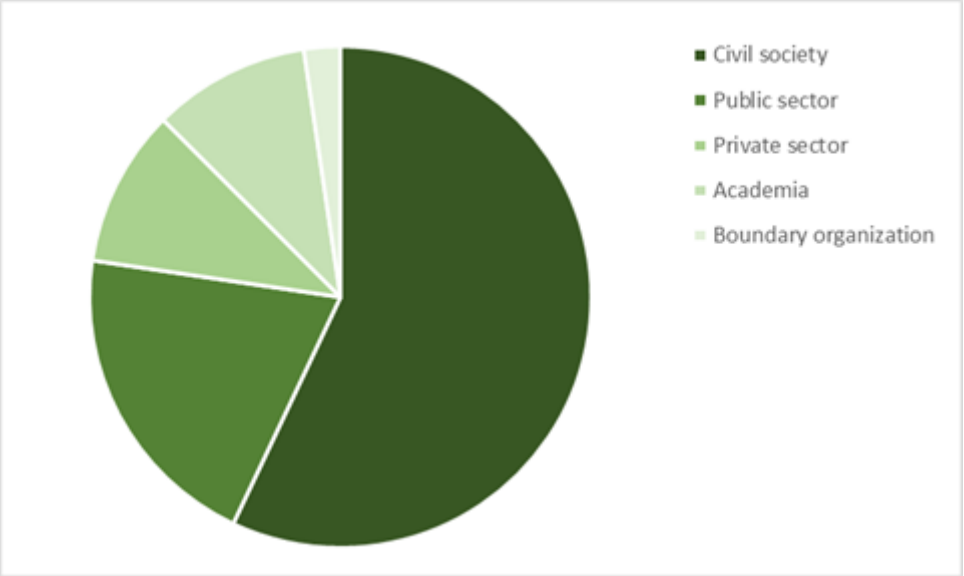

Figure 3.5. General types of stakeholders represented in the survey.

In terms of specific sub-groups, most respondents belonged to civil society actors in the field of plastic monitoring and clean-up (50 cases; 39.06%), followed by the public sector sub-group of national authorities (19 cases; 14.84%), the civil society group of other water monitoring activities (14 cases; 10.94%), the private sector group of waste management companies (10 cases; 7.81%), the civil society group of women's organizations (9 cases; 7.03%), the public sector group of local authorities (7 cases; 5.47%), the academia sub-groups of universities (7 cases; 5.47%) and other research entities (6 cases; 4.69%), the private sector sub-group of Corporate Social Responsibility (CSR) Initiatives (3 cases; 2.34%), and media as boundary organizations (3 cases; 2.34%) (Figure 3.6).

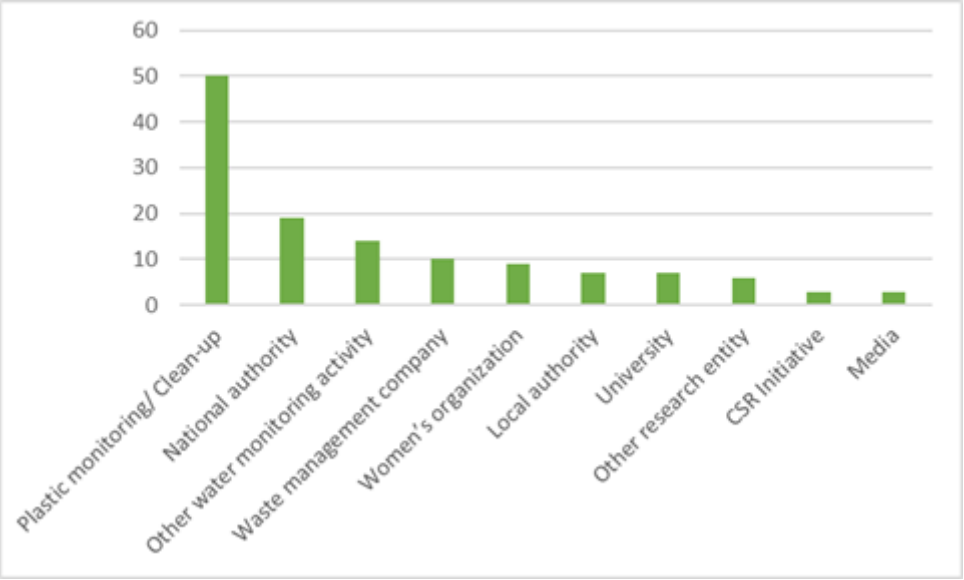

Figure 3.6. Specific types of stakeholders represented in the survey.

In terms of gender, the respondents were rather male (95 cases; 74.22%) than female (32 cases; 25.00%). One respondent preferred the gender not be disclosed (1 case; 0.78%) (Figure 3.7).

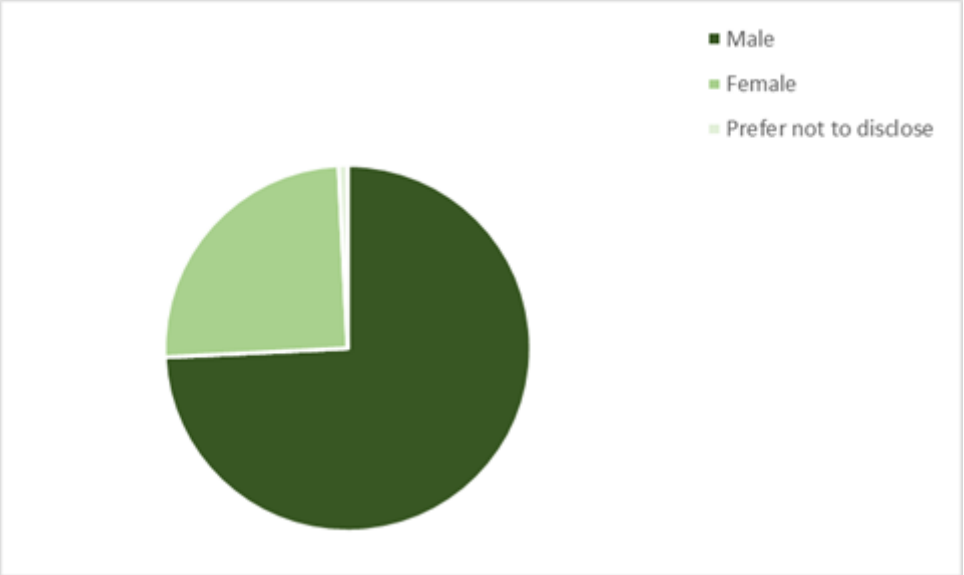

Figure 3.7. Gender of survey participants.

Regarding their main function in (plastic) monitoring and clean-up activities, most of the respondents are implementing clean-up activities (46 cases; 35.94%). 24 respondents are creating an enabling environment (17.75%), followed by the functions of communicating information (23 cases; 17.97%) and monitoring freshwater (17 cases; 13.28%). 15 respondents see another, not listed category as their main function (11.72%) and three people preferred not to disclose their answer (2.34%). Moreover, 15 respondents further specified their functions. However, these functions are not displayed in this report to secure anonymity (Figure 3.8).

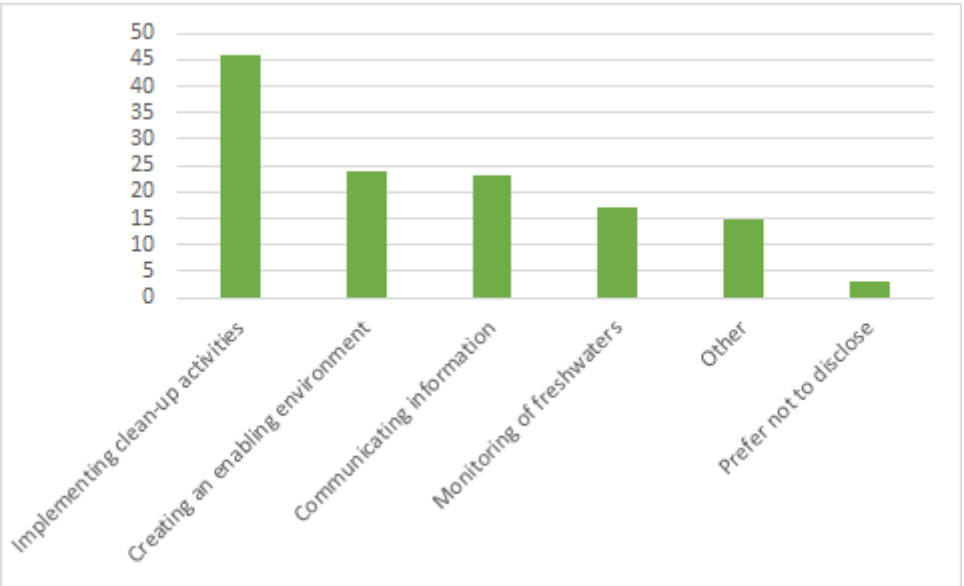

Figure 3.8. Main function of the respondents in (plastic) monitoring and clean-up.

The survey further asked about the years of experience of the respondents (Figure 3.9).

Out of 128 respondents, 39 (30.47%) have up to three years of experience in plastic clean-up activities and 36 (28.13%) respondents have more than six years of experience in plastic monitoring. This is followed by 27 respondents (21.09%) with no experience in plastic clean-up and 23 respondents (17.97%) with up to three years of experience. Three respondents (2.34%) have not replied to this question.

In terms of experience with plastic monitoring, 38 respondents (29.70%) have up to three years of experience, followed by 33 respondents (25.78%) who can point to more than six years of experience and 27 respondents (21.09%) indicating four to six years of experience. Furthermore, 27 respondents (21.09%) have no experience with plastic monitoring and 3 survey participants (2.34%) did not reply to this question.

In terms of experience with monitoring water quality, 40 respondents (31.25%) have more than six years of experience, followed by 23 respondents (17.97%) who have up to three years of experience and 14 respondents (10.94%) who have four to six years of experience with water quality monitoring. 49 respondents (38.28 %) have no experience with water quality monitoring and 2 respondents (1.56%) did not reply.

In terms of experience with hydrologic monitoring (water level/ discharge), more than half of the respondents have no experience with hydrologic monitoring (70 cases; 54.69%). 25 respondents (19.53%) stated that they have up to three years of experience, followed by 20 respondents (15.62%), who have more than six years of experience and seven respondents (5.47%) who have four to six years of experience. 6 people (4.69%) did not reply to the question.

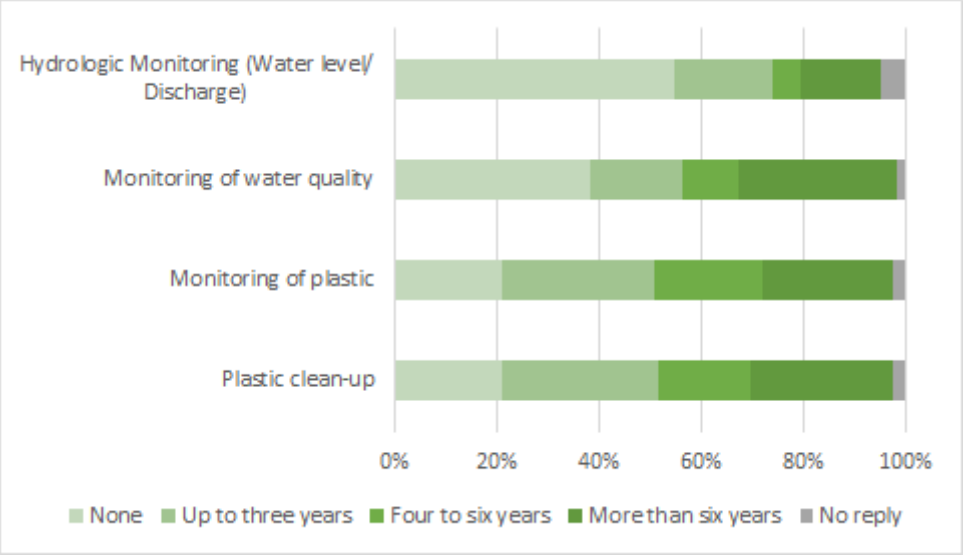

Figure 3.9. Years of experience among respondents.

Furthermore, 95 (74.22%) out of the 128 respondents are currently involved in monitoring or clean-up activities and 33 (25.78%) are currently not involved in such activities (Figure 3.10).

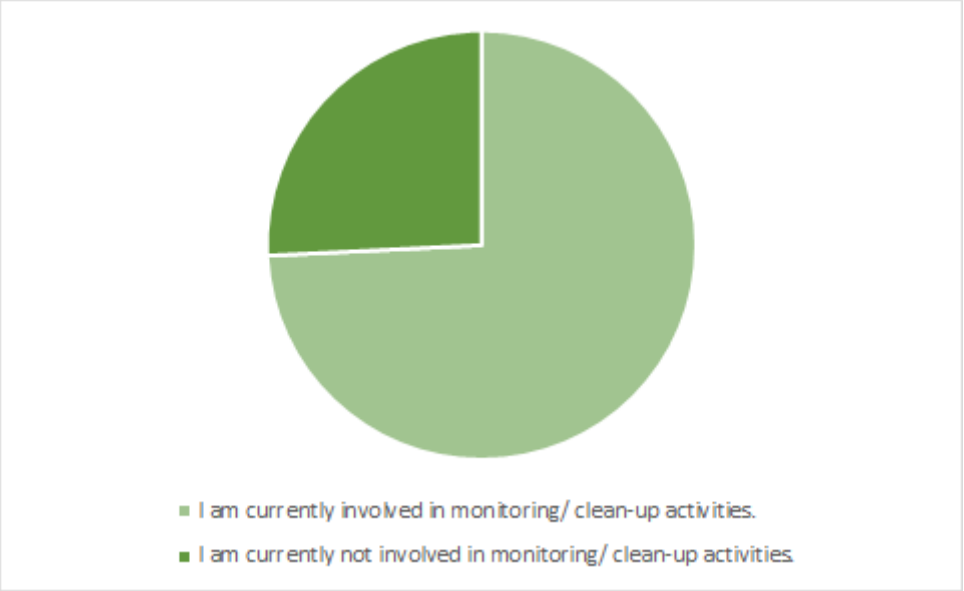

Figure 3.10. Current Involvement in monitoring/ clean-up activities of the respondents.

Out of the 95 respondents who are currently involved in monitoring or clean-up activities, 39 (41.05%) are involved in more than three monitoring or clean-up sites, followed by 30 respondents (31.58%) who are currently involved in two to three sites and 15 respondents (16.79%) who are currently involved in one site. 11 people (11.58%) did not reply to this question.

Moreover, 89 respondents (93.68%) of the 95 respondents that are currently involved in clean-up activities, specified the locations, types and names of water bodies they are currently working at (Figure 3.11). Most of those locations are located in Uganda (28 cases; 31,46%), followed by Kenya (23 cases; 25.84%) and Burundi (9 cases; 10.11%). 6 locations are in Egypt and South Sudan (6.74% each), 4 locations in Tanzania (4.50%) and 3 locations each in the Democratic Republic of Congo, Ethiopia and Sudan (each 3.37%). No sites were specified for Rwanda and 4 sites (4.50%) are not further specified.

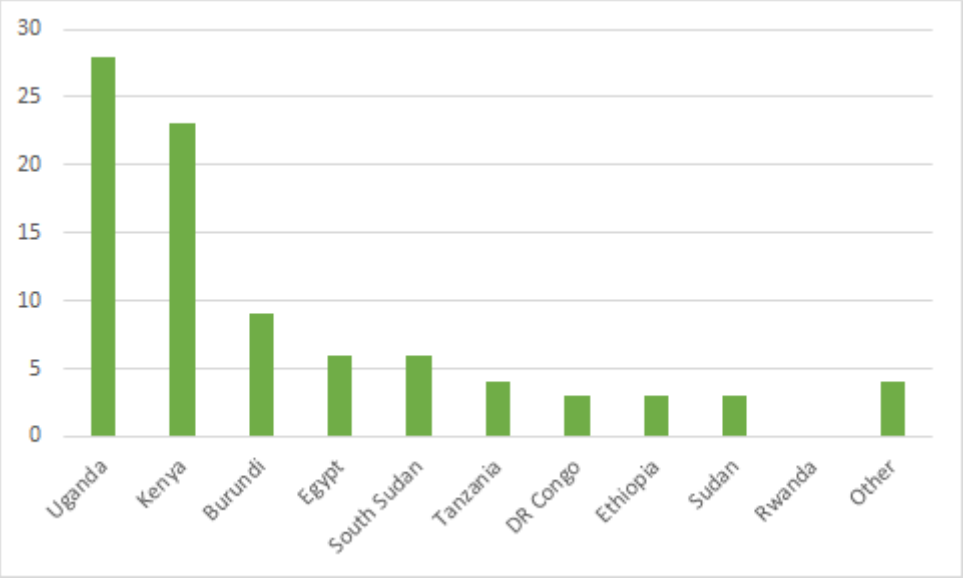

Figure 3.11. Locations of current sites.

Most of the current location sites are connected to Lake Victoria (25 cases). Work is being carried out on Lake Victoria from the Ugandan, the Kenyan, and the Tanzanian side. In addition, many different rivers and places were named. In some cases, it was also about working against plastic in slums in cities.

Finally, 47 respondents (36.72%) claimed that they were providing a personal answer to this questionnaire while the majority (81 cases; 63.28%) were speaking for a group (e.g., the answer for my organization) (Figure 3.12).

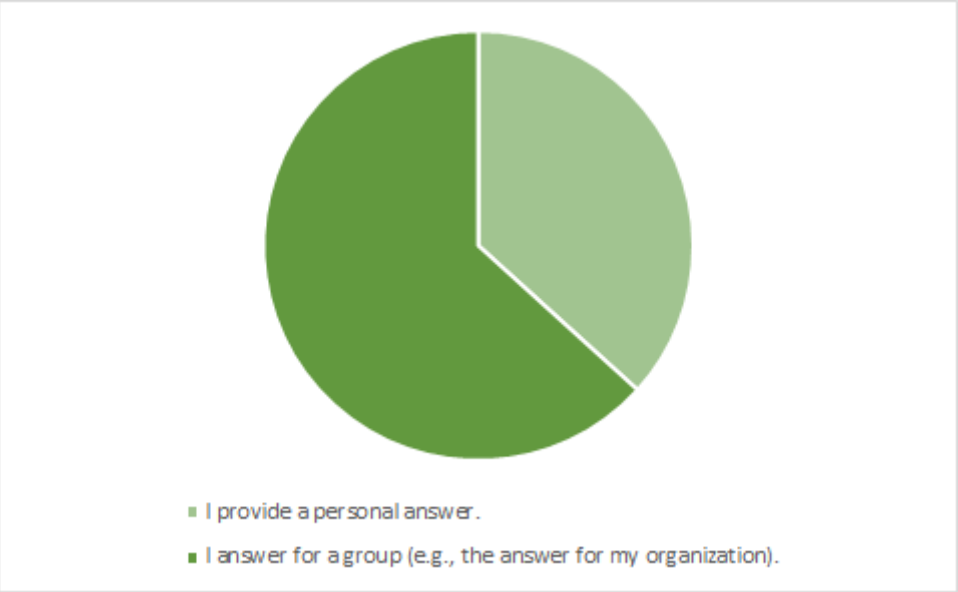

Figure 3.12. Personal answer versus answer for a group.

Enabling Environment

The second part of the survey addressed factors that enable good governance for the monitoring process. In total, nine factors were considered in the questionnaire and answer categories could vary between 1, indicating that a factor is lacking, and 4, indicating a factor is fully present.

In general, most of the factors were rated as somewhat lacking or lacking, with some variation between the questionnaire items (Figure 3.13).

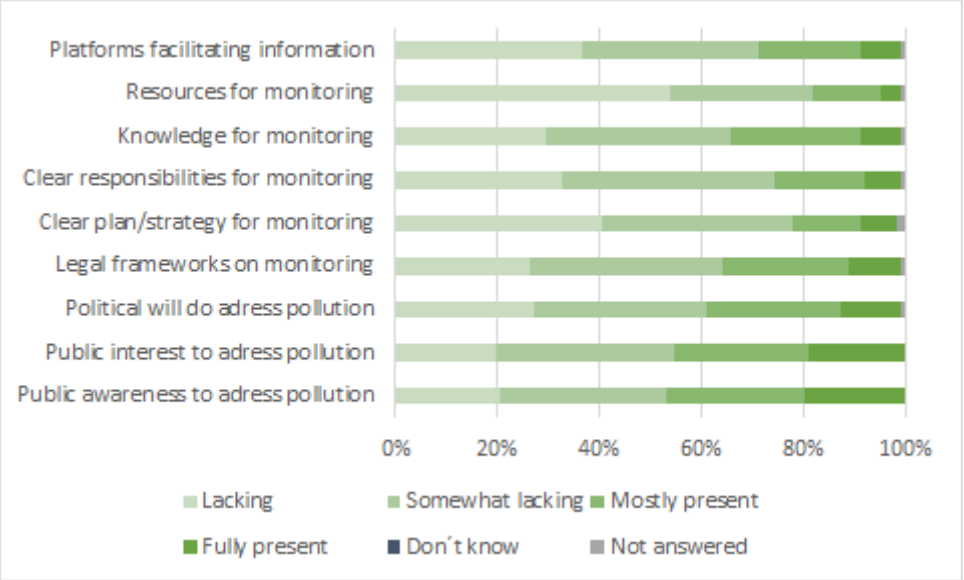

Figure 3.13. Enabling environment for monitoring and clean-up. Relative distribution.

The comparison of medians shows that 8 out of 9 factors (Public awareness of the problem of plastics pollution; Public interest to address (plastics) pollution; Political will to address plastic pollution; Legal frameworks on monitoring plastics; Clear plan/strategy to monitor plastics; Clear responsibilities for monitoring; Knowledge how to monitor plastics in freshwaters; Platforms facilitating information sharing regarding plastics pollution) are somewhat lacking with a median of 2. The factor resources to monitor plastics in freshwaters was the only one with a median of 1 and was thus lacking. In addition, there is some variation in the responses: In the Public Awareness and Public Interest categories, the median line overlaps with the line of the first quartile. In the Clear Plan/Strategy category, the median line overlaps with the marker of the 3rd quartile, and in the Resources category, the median line overlaps with the marker of the 1st quartile (Figure 3.14).

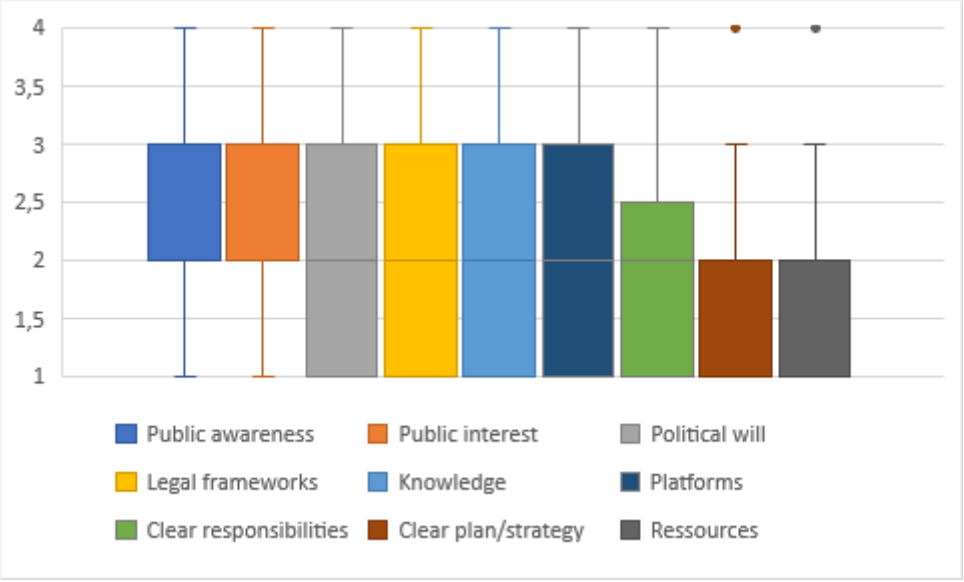

Figure 3.14. Enabling environment for monitoring and clean-up. Depicted are median values, lower and upper quartiles, minimum and maximum values.

Monitoring process

Section three of the questionnaire was about capacities and resources needed for implementing plastic monitoring activities. The survey addressed four types of capacities and resources (knowledge, technical equipment, human skills, and financial resources) in two phases of the monitoring process (data collection and data handling/ evaluation). In total, eight capacities/resources were considered in the questionnaire and answer categories could vary between 1, indicating that a factor is lacking, and 4, indicating a factor is fully present.

In general, most of the factors were rated as somewhat lacking or lacking (Figure 3.15), with some variation between the questionnaire items.

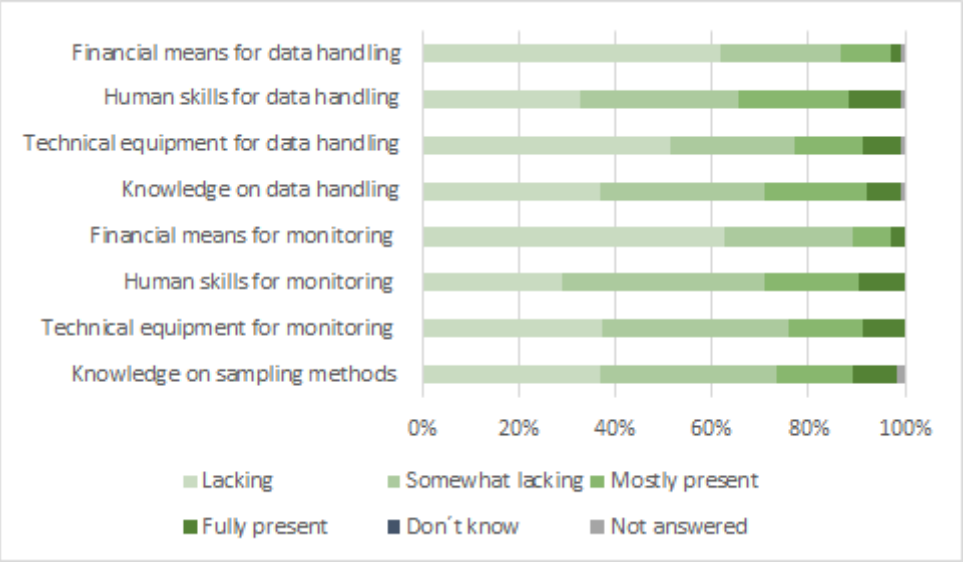

Figure 3.15. Capacities and resources in the monitoring process. Relative distribution.

The comparison of medians shows that 5 of 8 factors (Knowledge on sampling methods; Technical equipment for monitoring; Human skills for monitoring; Knowledge on data handling/ evaluation; Human skills for data handling/ evaluation; Platforms facilitating information sharing regarding plastics pollution) are somewhat lacking (median = 2). In addition, 3 of 8 factors (Financial means for data handling/ evaluation; Financial means for monitoring; Technical equipment for data handling/ evaluation) are fully lacking (median = 1). In case of the category 'Technical equipment for monitoring', the median line overlaps with the line of the 3rd quartile. For the categories 'Technical equipment for data handling', 'Financial means for data handling', and 'Financial means for monitoring', the median line overlaps with the 1st quartile (Figure 3.16).

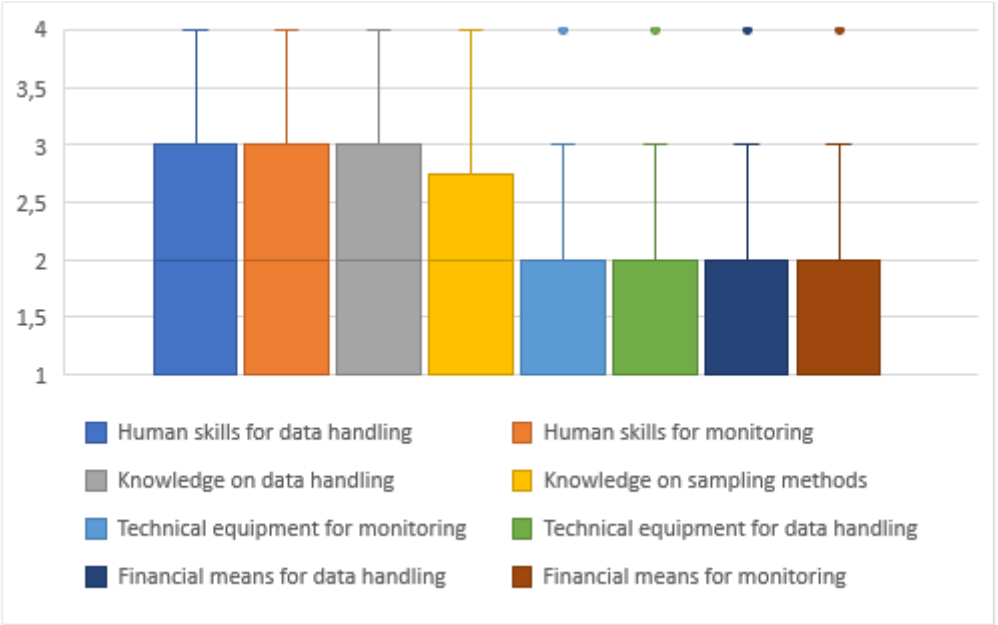

Figure 3.16. Capacities and resources in the monitoring process. Depicted are median values, lower and upper quartiles, minimum and maximum values as well.

Communication

Awareness at national level: Section four of the questionnaire was about the respondent's awareness of stakeholder groups in their country (outdegree) and their assumptions about other stakeholder's awareness of the respondent (or the respondents' organization/ entity). All five stakeholder groups were considered in the questionnaire and answer categories could vary between 1, indicating no awareness and 4, indicating full awareness.

With respect to the outdegree dimension, awareness was rather low (Figure 3.17), with some variation between the different stakeholder groups.

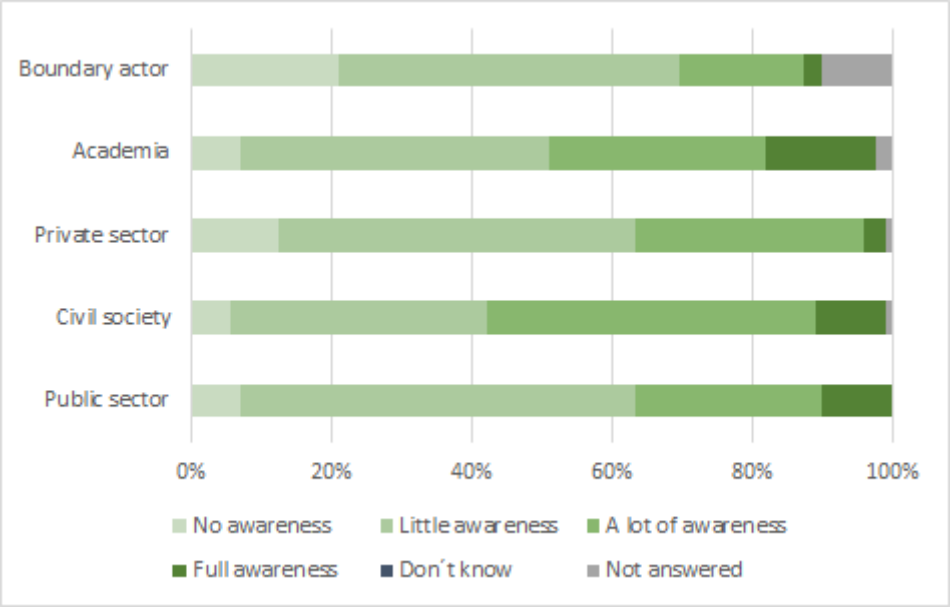

Figure 3.17. Awareness of stakeholder groups in their country (outdegree). Relative distribution.

Comparing the median values shows that the respondents have little awareness (median = 2) of 4 out of 5 stakeholder groups (Public sector; Private sector; Academia; Boundary organization). The only stakeholder group for which respondents indicate rather high awareness is civil society (median = 3). Further, in terms of civil society, the median line overlaps with the 3rd quartile line. For the stakeholder groups academia, public sector, and private sector the median lines equal the 1st quartile line (Figure 3.18).

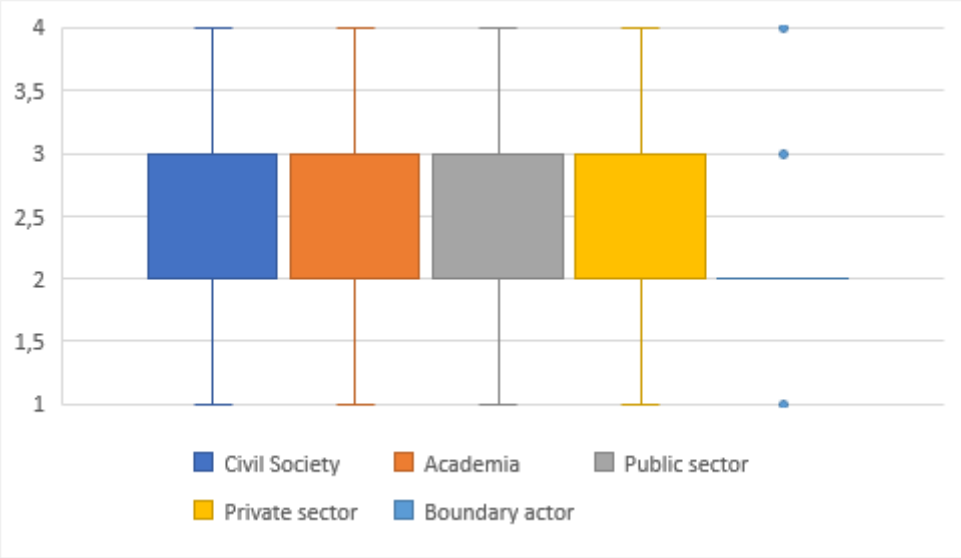

Figure 3.18. Awareness of stakeholder groups in their country (outdegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

In terms of awareness of other stakeholders (indegree), similar responses are provided. First, respondents rather indicate no and little awareness, with some variations between stakeholder groups (Figure 3.19).

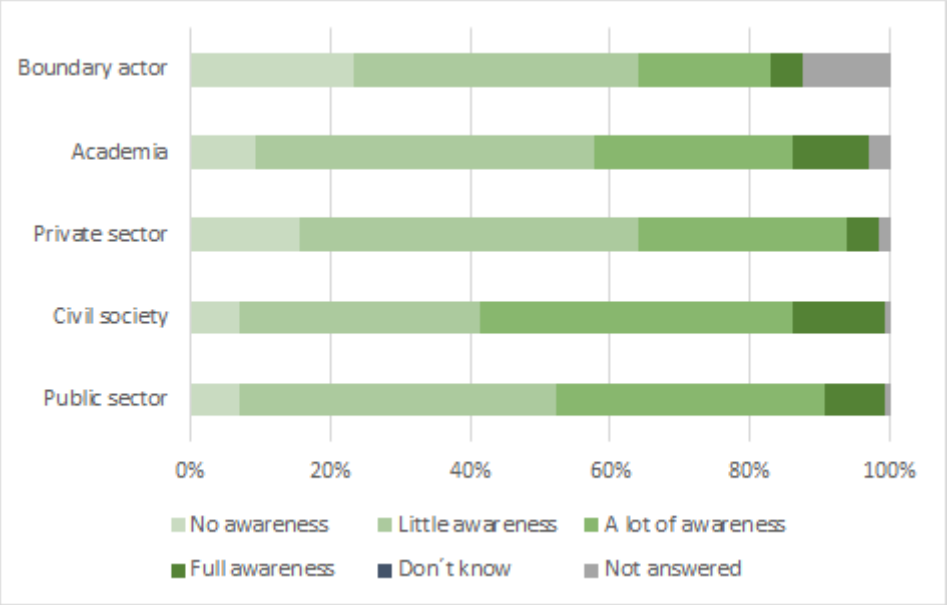

Figure 3.19. Awareness of stakeholder groups in their country (outdegree). Relative distribution.

With respect to median values, results show a median of 2 for most of the stakeholder groups (Public sector; Academia; Private sector; Boundary actor). Here too, only the median for civil society stands out (median = 3). Furthermore, in terms of the groups Public sector, Academia, and Private sector, the median line overlaps with the line of the first quatile. In terms of the civil society actor the median lines overlaps with the 3rd quatile line (Fig. 3.20).

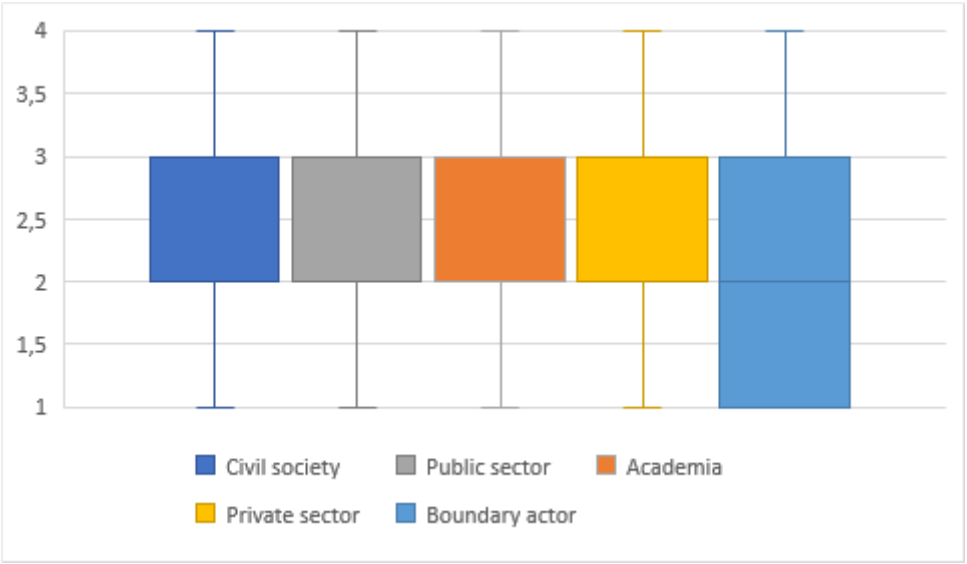

Figure 3.20. Awareness of stakeholder groups in their country (indegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

The survey further asked about the three most effective ways of how the stakeholders become aware of each other at national level (Figure 3.21). Answers to this question reveal that indirect ways are the most effective ways to foster mutual awareness. In fact, for 94 respondents (73.44%), the indirect way

to foster awareness through platforms and websites is the most promising one. This is followed by 92 respondents (71.88%) for whom the indirect way through presentations at events is the most effective one. Another 80 respondents (62.50%) prefer direct communication in person like in meetings or at events. The indirect way through formal reporting mechanism was effective for 53 respondents (41.41%). This was followed by the direct way of fostering awareness via mail (51 respondents; 39.84%) and phone (12 respondents; 9.38%). 11 respondents (8.59%) selected the option "other".

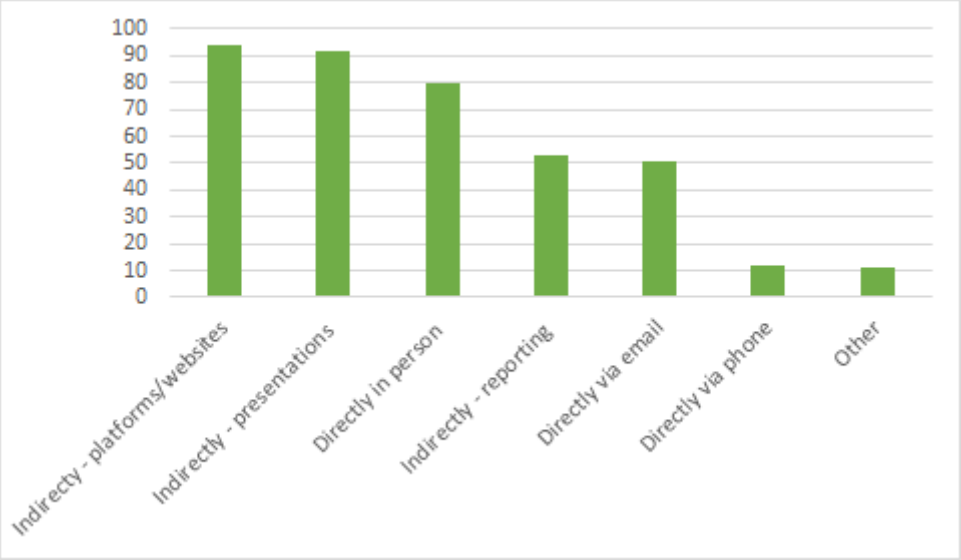

Figure 3.21. How stakeholders become aware of each other at national level. Depicted are total numbers of respective mechanisms to increase awareness.

Awareness at international level: The questionnaire also asked about the respondent's awareness of stakeholders in other countries (outdegree) and their assumptions about other country's stakeholder's awareness of the respondent's country. All ten Nile Riparian states were considered in the questionnaire and answer categories could vary between 1, indicating no awareness and 4, indicating full awareness.

With respect to the outdegree dimension, awareness was rather low (Figure 3.22), with some variation between the different countries.

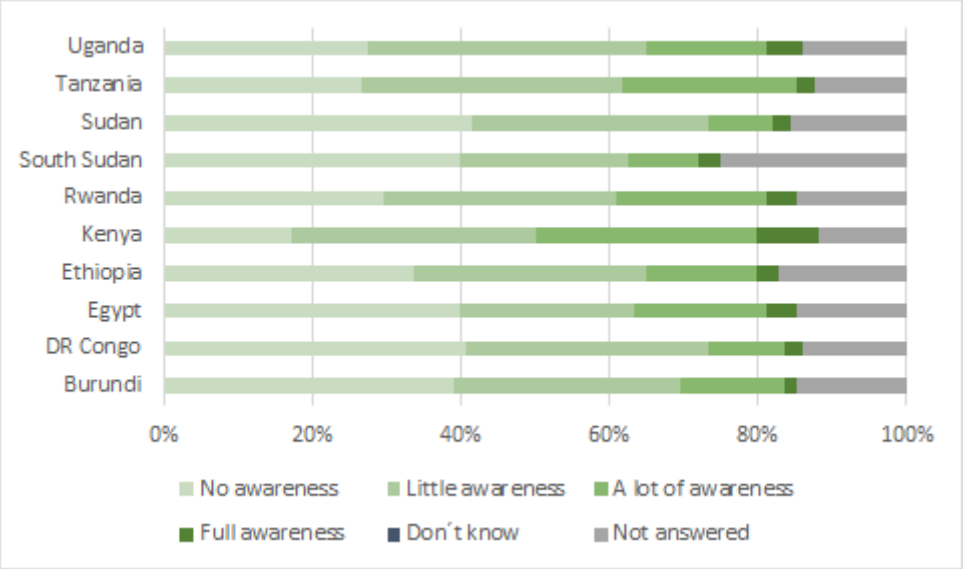

Figure 3.22. Awareness of stakeholders in other countries (outdegree). Relative distribution.

Based on a comparison of median values, the respondents have little awareness (median = 2) of stakeholders in the other 10 Nile riparian states. However, there is some variation as well. In the case of Uganda and Kenya, the median line and the line of the first quartile are overlapping. In the case of Ethiopia, Burundi, South Sudan, DR Congo, and Sudan, the median line overlaps with the 3rd quartile line (Figure 3.23).

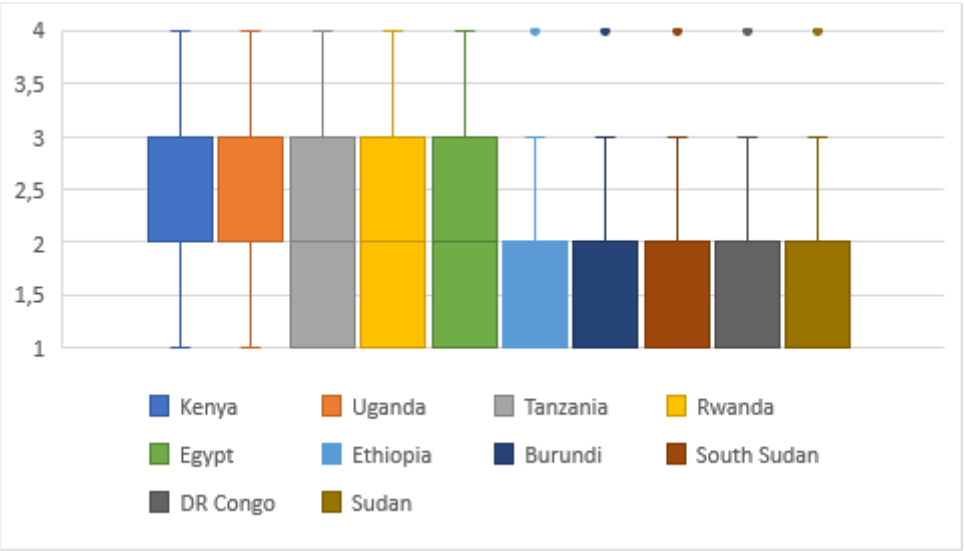

Figure 3.23. Awareness of stakeholders in other countries (outdegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

There are similar results regarding the awareness, other country's stakeholders have of the stakeholders in the respondent's country (indegree dimension). Here again, awareness was rather low (Figure 3.24), with some variation between the different countries.

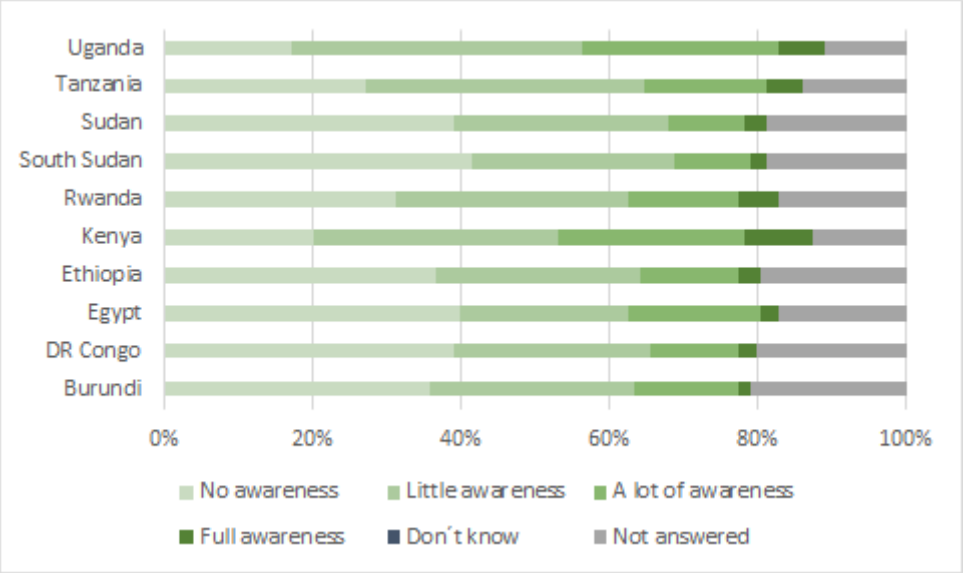

Figure 3.24. Awareness expected from stakeholders in other countries (indegree). Relative distribution.

The comparison of median values further shows that the respondents expect little awareness (median = 2) for 9 of the 10 respective countries. South Sudan is the only country with a median value of 1, meaning that the stakeholders in South Sudan expect no awareness of the respondent's work. Further, in terms of the countries Kenya and Uganda, the median values overlap with the 1st quartile. In the case of South Sudan, the median overlaps with the first quartile line. For the other 7 countries the median lines overlap with the 3rd quartile lines (Figure 3.25).

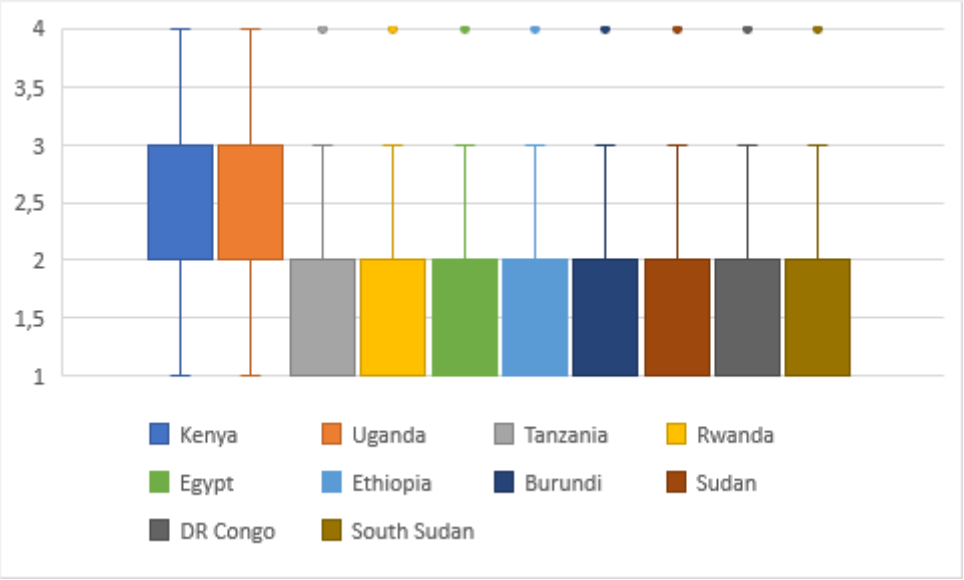

Figure 3.25. Awareness expected from stakeholders in other countries (indegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

The survey further asked about the three most effective ways of how the stakeholders get aware of each other at international scale (Figure 3.26). The most prominent way of fostering awareness was to meet

directly in person in meetings or at events (92 cases, 71.88%). This was followed by 89 respondents (69.53%) who selected the indirect way through formal reporting mechanisms, 81 respondents (63.28%) emphasizing the indirect way through presentations at events, 56 respondents (43.75%) pointing out to the indirect way through platforms or websites, 52 respondents (40.63%) hinting to the direct way via email, and 17 respondents (13.28%) emphasizing the direct way via phone. 13 People (10.16%) selected the option "other".

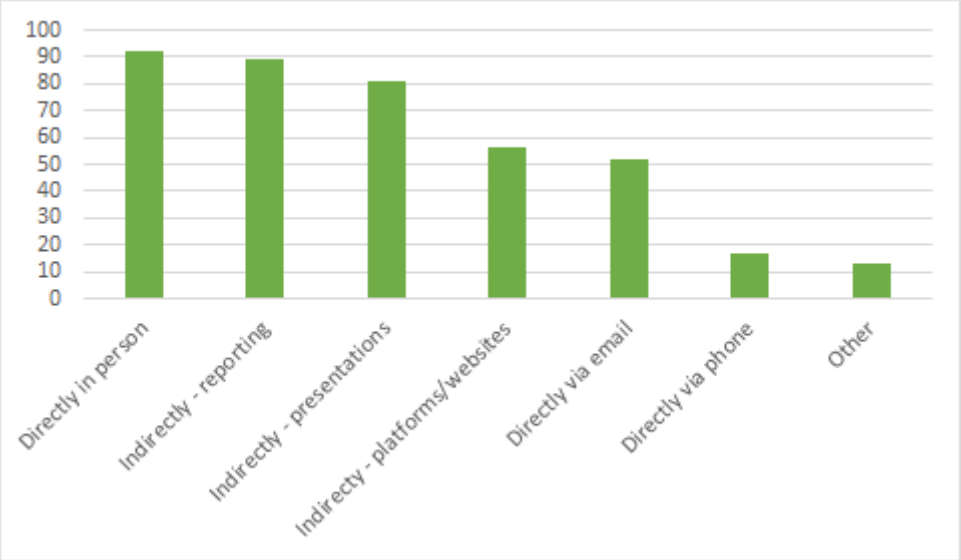

Figure 3.26. How stakeholders become aware of each other at international level. Depicted are total numbers of respective mechanisms to increase awareness.

Information sharing at national level: The next section in the questionnaire was about the amount of information shared with stakeholders in their country. Again, all five stakeholder groups were considered in the questionnaire and answer categories could vary between 1, indicating no information sharing and 4, indicating full information sharing.

With respect to the outdegree dimension, awareness was rather low (Figure 3.27), with some variation between the different stakeholder groups.

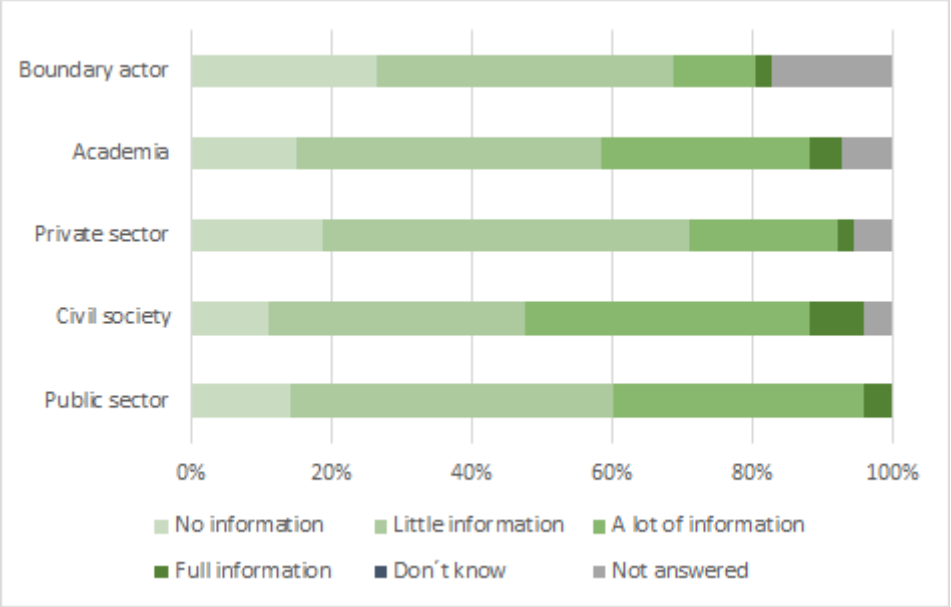

Figure 3.27. Information sharing with stakeholder groups in their country (outdegree). Relative distribution.

The comparison of median values shows that most of the respondents share little information with other stakeholder groups in the public, private, and academic sector as well as for the category boundary actor (median = 2). A lot of information (median 3) is shared with stakeholders from civil society (Figure 3.28). For the civil society actor, the median is overlapping with the 3rd quartile. In the case of the public sector and the academic sector, the median values and the 1st quartiles are overlapping. Further, in terms of boundary actors, the median is overlapping with the 3rd quartile (Fig. 28).

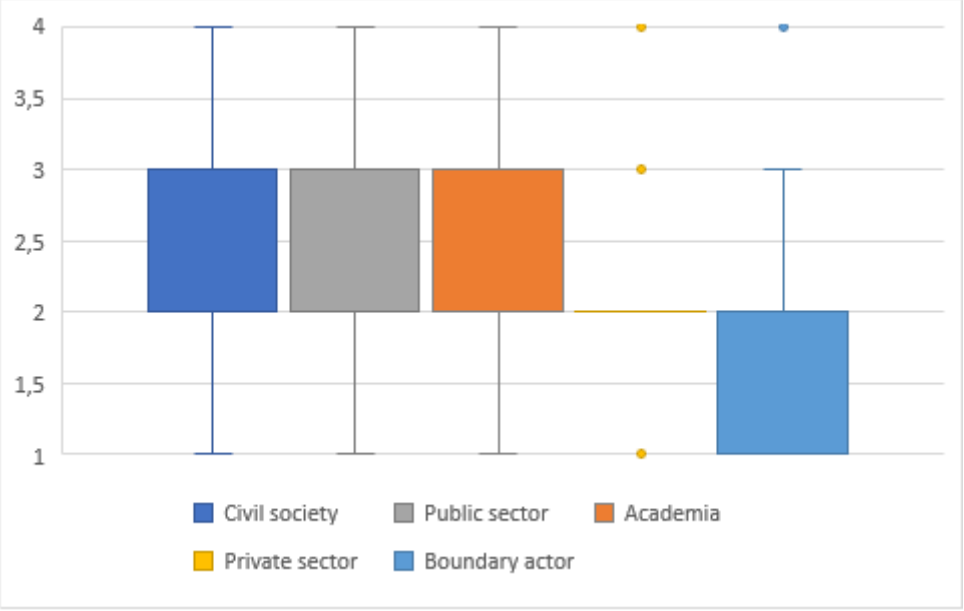

Figure 3.28. Information sharing with stakeholder groups in their country (outdegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

In terms of information sharing of other stakeholders (indegree), similar responses are provided. First, respondents rather indicate no and little information sharing, with some variations between stakeholder groups (Figure 3.29).

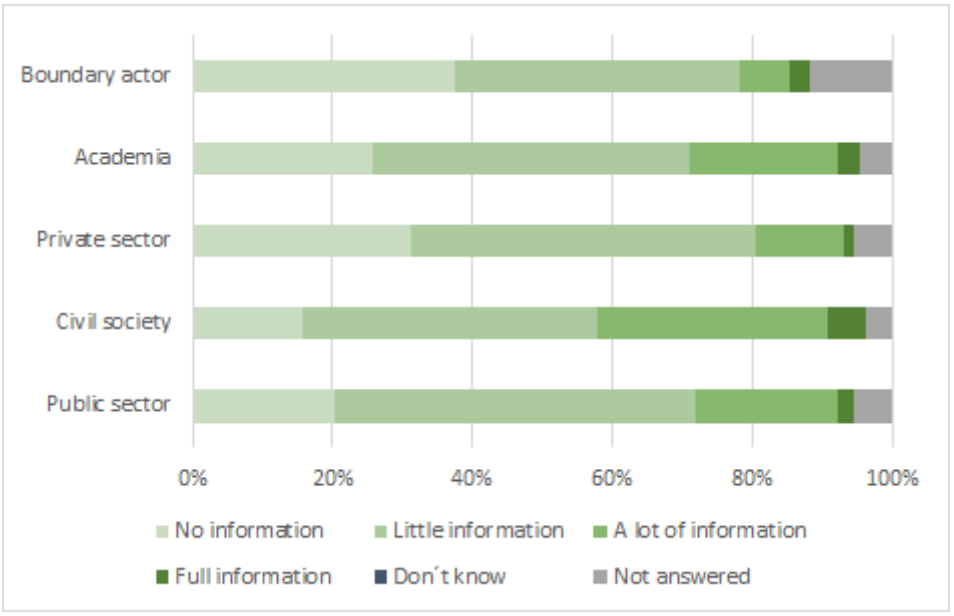

Figure 3.29. Information sharing of other stakeholder groups in their country (indegree). Relative distribution.

Comparing median values reveals that little information is shared (median = 2) with all 5 stakeholder groups. Further, in terms of the civil society actor, the median line and the 1st quartile line are overlapping. With respect to the stakeholder groups academia and boundary actors, the median overlaps with the 3rd quartile (Figure 3.30).

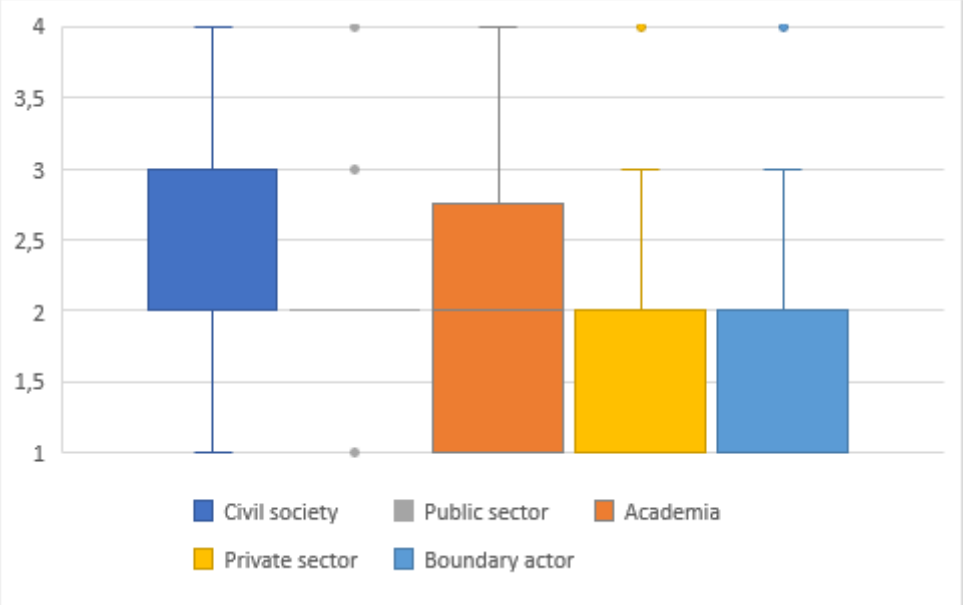

Figure 3.30. Information sharing of other stakeholder groups in their country (indegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

The survey also asked about the three most effective ways of sharing information (Figure 3.31). In this case, the indirect ways are seen as the more effective ones. In fact, the indirect way through platforms or websites was selected most (107 cases; 83.59%), followed by the indirect way through presentations at events (88 cases; 68.75%), and the indirect way through formal reporting mechanisms (73 cases; 57.03%). The most effective direct way of sharing information was to meet in person in meetings or at events (55 cases; 42.97%), followed by sharing information via mail (33 cases; 25.78%) and directly via phone (30 cases; 23.44%). 20 respondents (15.6%) selected the option "other".

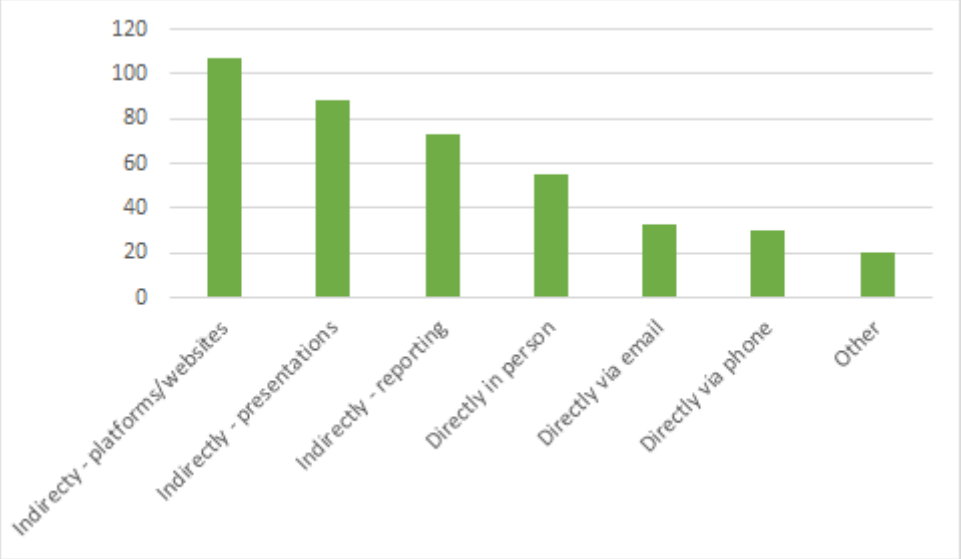

Figure 3.31. Most effective ways for sharing information (national scale).

Information sharing at international level: The survey further asked how much of the available information on plastics in freshwater the respondents share with stakeholders in the other countries (outdegree). All ten Nile Riparian states were considered in the questionnaire and answer categories could vary between 1, indicating no information sharing and 4, indicating full information sharing.

With respect to this outdegree dimension, information sharing was rather low (Figure 3.32), with some variations between the different countries.

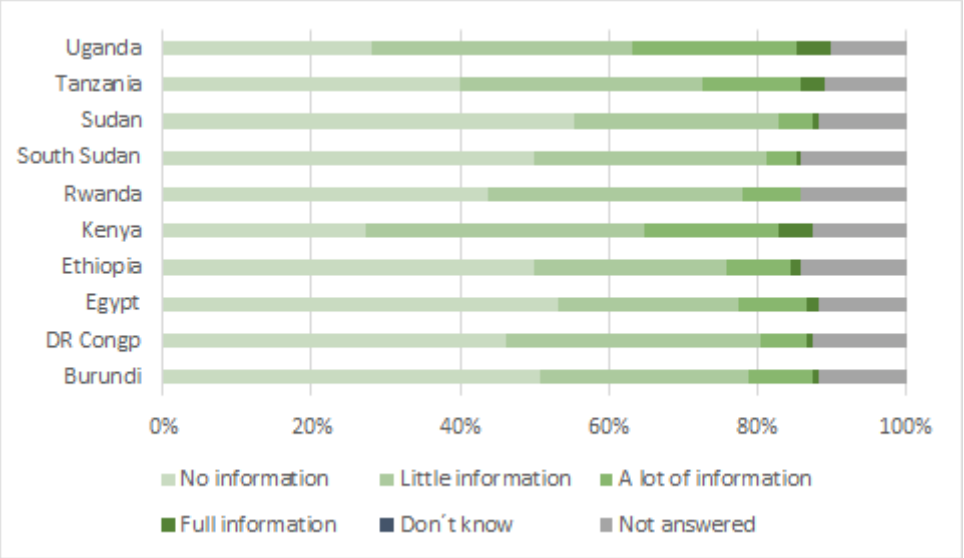

Figure 3.32. Information sharing of stakeholders with other countries (outdegree). Relative distribution.

Further analyses reveal that 7 out of 10 countries (Rwanda, DR Congo, Ethiopia, Burundi, Egypt, South Sudan, Sudan) have a median value of 1, meaning that there is no sharing of information. For Kenya, Tanzania and Uganda, however, the median value was 2, meaning that there is little information that is being shared. Further, in the case of Tanzania, the median value is overlapping with the 3rd quartile. For the cases of Rwanda, DR Congo, Ethiopia, Burundi, Egypt, South Sudan and Sudan the median value is overlapping with the 1st quartile (Figure 3.33).

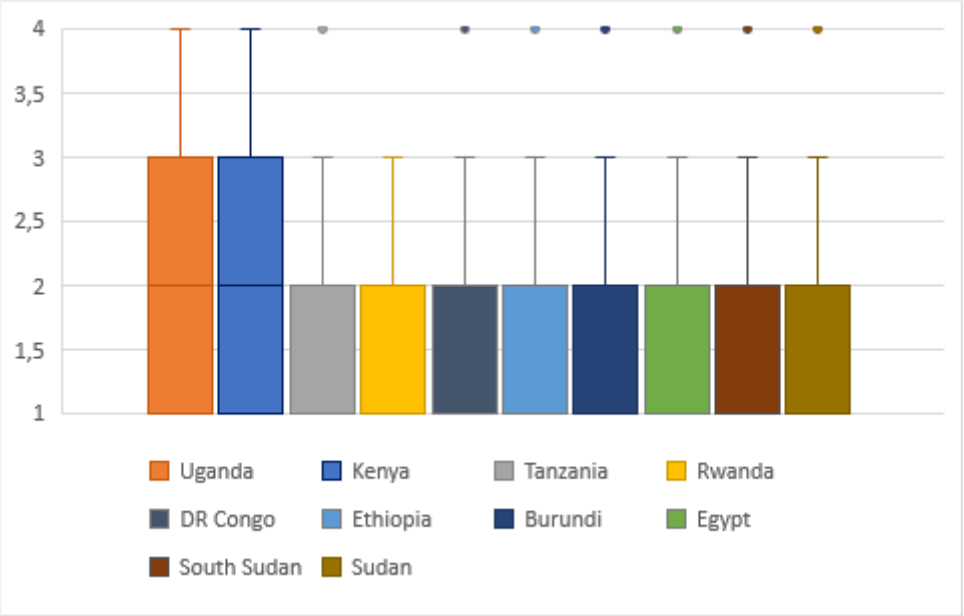

Figure 3.33. Information sharing of stakeholders with other countries (outdegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

The survey further asked about the perceived level of information sharing by stakeholders in other countries (indegree).

With respect to this indegree dimension, information sharing was again rather low (Figure 3.34), with some variations between the different countries.

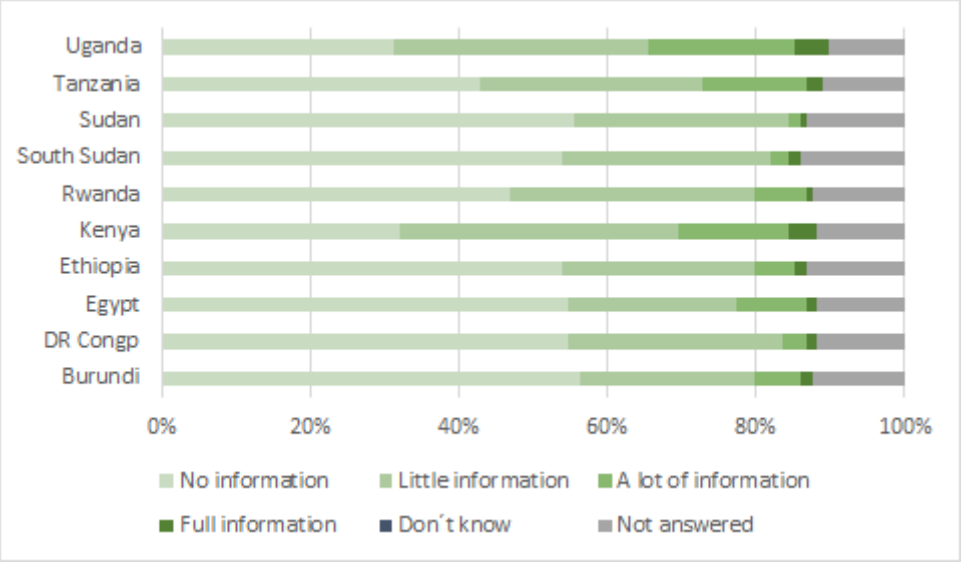

Figure 3.34. Information sharing of stakeholders from other countries (indegree). Relative distribution.

Further analysis shows that 7 out of 10 countries have a median of 1, meaning that no Information is being shared. Here also, Kenya, Tanzania and Uganda have a slightly higher value, with a median of 2, meaning that little information is being shared.

In the cases of Tanzania and Kenya, the median values are overlapping with the 3rd quartile. For the cases of Rwanda, DR Congo, Ethiopia, Burundi, Egypt, South Sudan, and Sudan, the median value is overlapping with the 1st quartile (Figure 3.35).

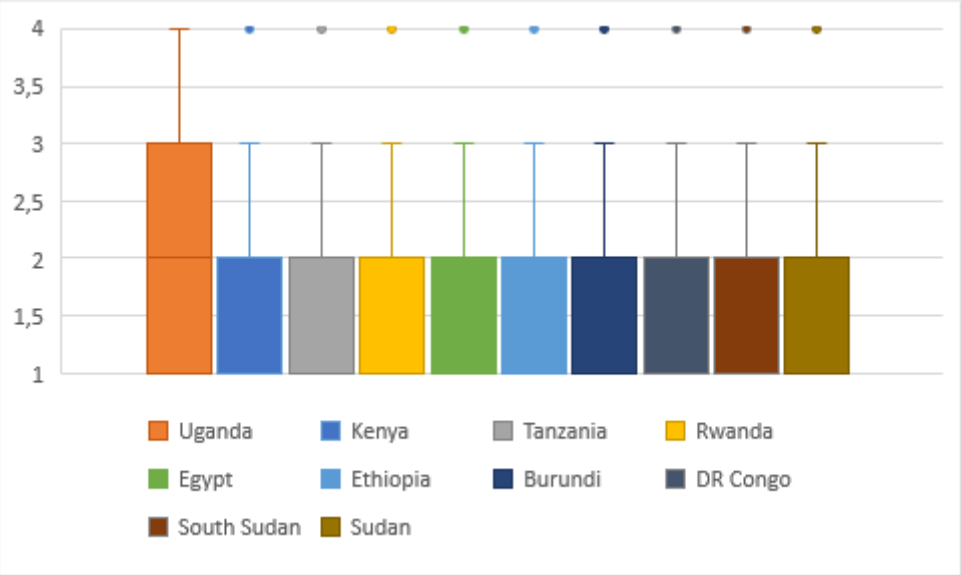

Figure 3.35. Information sharing of stakeholders from other countries (indegree). Depicted are median values, lower and upper quartiles, minimum and maximum values.

We then asked about the three most effective ways of sharing information at international scale (Figure 3.36). Here, the indirect ways are seen as the more effective ones. The indirect way through formal reporting mechanisms was selected most (99 cases; 77.34%), followed by the indirect way through presentations at events (87 cases; 67.97%) and the indirect way through platforms or websites (87 cases; 67.97%). The most effective way of sharing information directly was in person in meetings or at events (51 cases; 39.84%), followed by information sharing via email (35 cases; 41.41%), and via phone (15 cases; 11.72%). 11 respondents (8.59%) selected the option "other".

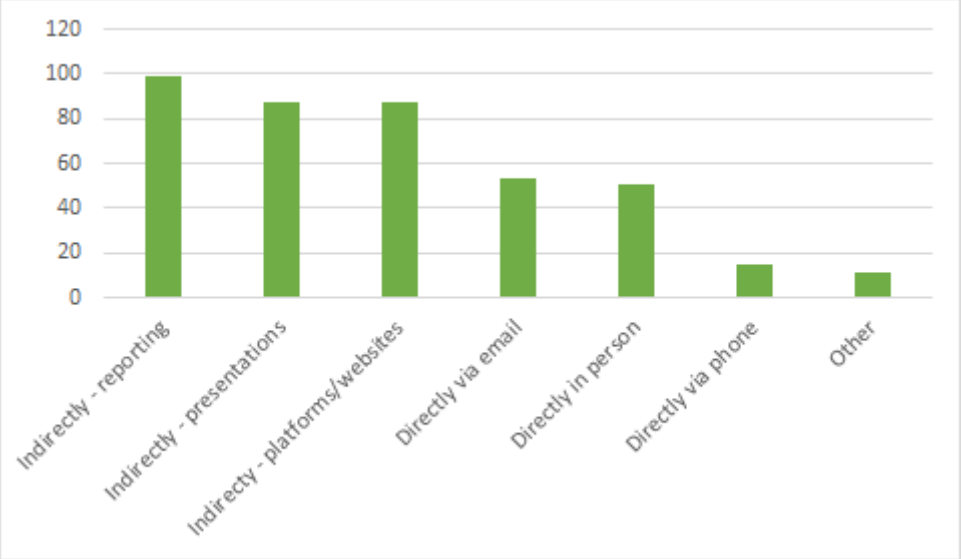

Figure 3.36. Most effective ways for sharing information (international scale).

Factor analysis

Enabling environment: In terms of enabling environment, the nine variables are highly correlated, resulting in the reduction to one factor 'enabling environment'.

Monitoring process: Likewise, factor analysis related to the monitoring process reveals that the 8 variables on data collection and data handling/evaluation are highly correlated, resulting in the reduction to one factor 'Resources and capacities in the monitoring process'.

Communication: In terms of awareness at **national scale**, the 10 variables related to in- and outdegree are also highly correlated, resulting in 2 factors: Factor 1 relates to 'mutual awareness at national scale amongst the public, private, and academic sector'. Factor 2 relates to 'mutual awareness at national scale with the civil society sector'. Likewise, regarding information sharing at national scale, the 10 variables related to in- and outdegree are also highly correlated, resulting in 2 factors: Factor 1 relates 'mutual information sharing at national scale amongst the public, private, and academic sector'. Factor 2 relates 'mutual information sharing at national scale with the civil society sector'. Additional factor analysis including both awareness and information sharing does not result in a further reduction of variables to factors.

In terms of awareness at **international scale**, the 20 variables for in- and outdegree are also highly correlated, resulting in 2 factors: Factor 1 relates to 'mutual awareness at international scale amongst

seven downstream countries'. Factor 2 relates to 'mutual awareness at international scale among the three upstream countries Kenya, Tanzania, and Uganda'. Likewise, in terms of information sharing at international scale, the 20 variables for in- and outdegree are also highly correlated, resulting in 2 factors: Factor 1 relates to 'mutual information sharing at international scale amongst seven downstream countries'. Factor 2 relates to 'mutual information sharing at international scale among the three upstream countries Kenya, Tanzania, and Uganda'. As for the national scale, additional factor analysis including both awareness and information sharing does not result in a further reduction of variables to factors.

Gender differences

In most cases, the Mann-Whitney-U test did not reveal significant differences between male and female respondents with respect to assessments of the enabling environment, the monitoring process, and communication. However, there are two exceptions to this: First, there is a significant difference between male and female respondents regarding 'indegree' information sharing at national scale within academia (.038), with male respondents reporting higher values than female respondents (middle rank male respondents: 64,62; middle rank female respondents: 50,50). This means that men rather think that academia shares information than female respondents. Second, there is a significant difference between men and women regarding 'indegree' information sharing at international level for Tanzania (.44). Here, male respondents report higher values than female respondents (middle rank male respondents: 60,28; middle rank female respondents: 47,05). This means that men rather think that information is shared with Tanzania than female respondents.

3.3. Insights from the Scoping Mission

In addition to the survey, a team from GIZ, NBI, and the authors of this report conducted stakeholder consultations with various groups in Uganda and Kenya in September 2024. These consultations provided insights into ongoing activities, opportunities for improving macroplastic monitoring, and the barriers hindering its effective implementation.

In total, 12 different stakeholders were visited. The stakeholders included local stakeholders covering local environmental authorities, wastewater treatment facilities, drinking water production facilities, and waste management facilities. Also, regional and national stakeholders such as the National Fisheries Resources Research Institute (NaFIRRI) of Uganda and the Kenyan Water Resources Authority (WRA) have been consulted. In addition, international organizations such as the NBD and the Lake Victoria Basin Commission were visited. A list of stakeholders visited is provided in the NBD Report "Mapping key CSO Actors in the plastic pollution monitoring in the Nile Basin Countries" (NBD, 2024). Overall plastic is perceived as a pressing environmental problem which requires knowledge and action. Discussion with the stakeholders revealed that there is a lot of potential for integrating macroplastic monitoring into their operations.

Along the line of environmental flows of plastics, stakeholders can be categorised in two groups: (i) stakeholder active at the source, in particular those involved in waste management such as waste pickers in recycling and sorting facilities and (ii) stakeholders situated along paths from the sources to the aquatic environment, such as wastewater treatment plant operators or stormwater infrastructure

maintainers. For the water bodies, stakeholders comprise water authorities and institutes but also NGOs that are active in clean up of rivers and lakes.

None of the consulted stakeholders is currently involved in a macroplastic monitoring programme. However, the National Fisheries Resources Research Institute (NaFIRRI) has conducted projects on the occurrence of microplastic in surface water, sediments and shores of Lake Victoria (Egessa et al. 2020a,b). But there are ample opportunities to leverage ongoing activities to be integrated into a macroplastic monitoring programme. For example, in waste management the amounts and types of plastic collection are known and data is reported to authorities. Such data flows into waste management statistics which, e.g., can be used as surrogate data to assess the potential for plastic transport into the River network of the Nile basin (Shesh et al. 2022). Also, NGOs such as the Uganda Junior Rangers, take record of the amounts of plastics collected which could potentially be integrated into a monitoring programme.

In other cases, plastic litter and other material is collected but typically not quantified or data is not reported. This is for example the case in waste water treatment plants where plastics can block the inlet pipes (as reported by the National Water and Sewerage Corporation Works in Jinja, Uganda) and for stormwater channels where stormwater infrastructure maintainers and NGOs remove or intentionally trap litter to avoid downstream transport (e.g. in Jinja, Figure 3.37).

With stakeholders from the Kenyan Water Resources Authority (WRA), responsible for water quality monitoring of rivers, lakes and groundwater and pollution control compliance , it was discussed if macroplastic monitoring can be integrated into existing water quality monitoring programmes. Simple visual counting methods can be easily integrated into the routine water quality monitoring.

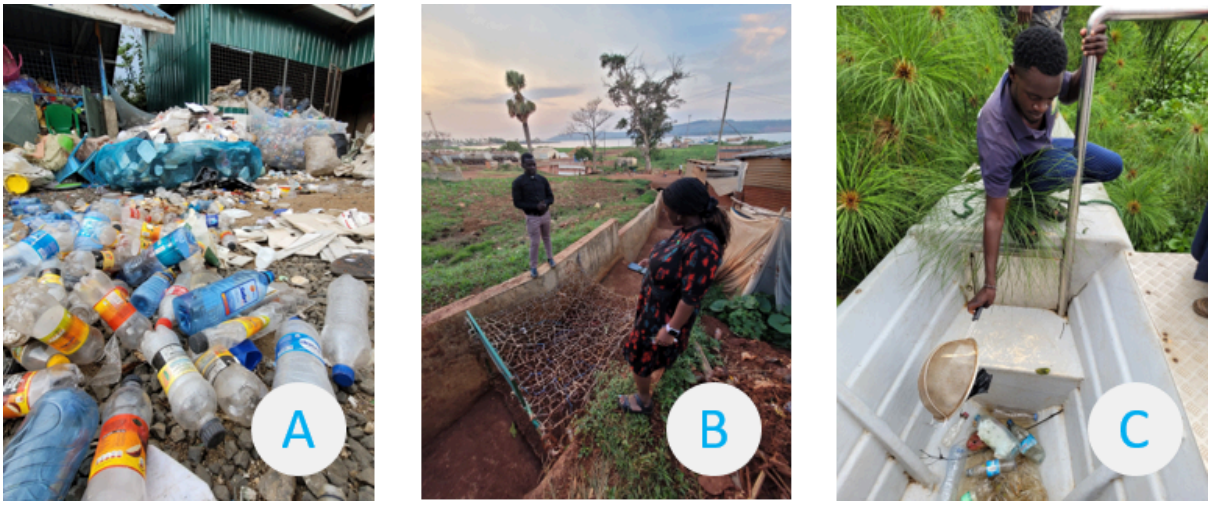

Figure 3.37: a) Material Recovery Facility (MRF) in Kisumu (Kenya) where waste collected by waste pickers is sorted for further processing b) Stormwater channel in Jinja (Uganda) equipped with a net to intercept plastic litter flows from the city into Lake Victoria c) A member of the Uganda Junior Rangers based in Kampala (Uganda) collects plastic litter from the shore of Namalusu Island in Lake Victoria

3.4.Discussion methodical questions and next steps

In terms of the survey, there are several methodological issues which should be considered when interpreting these results: In terms of stakeholders, the particularly high number of stakeholders from the civil society sector may go back to the high effectiveness of the Nile Basin District to identify stakeholders in the basin. With respect to the challenges, the context of this analysis as a GIZ-funded initiative may have influenced the expectations and answer behavior of the respondents. Further, the particularly high correlation between the questionnaire items may go back to lacking time or willingness of the respondents to provide fine-grained, differentiated answers to the questions. In addition, the answers may not be representative as there are particularly high response rates from certain gender (male), countries (Uganda and Kenya), and groups (civil society). Finally, a lack of differences in gender may go back to exactly this issue of low response rates from female respondents as compared to male respondents, influencing the potential of significant levels in the statistical analysis. There are, in fact, several potential gender differences close to .5 significant levels with respect to knowledge which may be of relevance as well.

Against this background, we suggest checking back, based on focus group discussions, how these results should be interpreted. In addition, it should be discussed amongst the key stakeholders how these assessments of stakeholders and capacities guide action to increase plastic monitoring for action against plastic pollution in the Nile basin. These discussions may include, but should not be limited to, the provision of an NBI plastic platform for knowledge exchange related to the enabling environment, actual monitoring, and communication, including the possibility to offer and ask for support based on specific skills and needs. In the future, we suggest a cross-check regarding stakeholders and skills to evaluate the effects of such platforms for the sake of plastic monitoring and management. Such future analyses could also analyze the effects of additional characteristics of respondents such as the effect of various countries, stakeholder groups, etc., which was not possible in this research due to the low response rates of certain groups and countries.

4. Conclusions

4.1 Reflection on monitoring methods

Unlike microplastics, macroplastics can be monitored by simple methods such as visual counting because macroplastics can be detected by eye. The review of scientific studies on macroplastic monitoring showed that visual counting of floating macroplastics is among the most frequent methods used to observe macroplastics in rivers. Such simple methods do not require comprehensive field equipment or laboratory infrastructure. They can be performed by non-experts and by citizen scientists which only need basic training.

4.2. Reflection on monitoring

Compared to other regions in the world, data on macroplastic in the Nile Basin is relatively sparse. However, also globally the data availability on macroplastic is generally limited. Currently no systematic macroplastic monitoring programmes are operational neither in the Nile Basin nor globally. Macroplastic observations typically involve sporadic measurements taken at limited locations and times, often for exploratory studies. Collection and clean-up initiatives have often operated over multiple

years. However, their focus is on collecting plastics not on monitoring. They often report the amount (mass) of plastic collected but do not use harmonised protocols. With harmonized methods for data collection and reporting, these activities provide opportunities to be integrated into systematic monitoring programmes.

4.3. Reflection on resources and capacities

This study aimed at understanding the stakeholder landscape as well as capacity potentials and challenges with respect to plastic monitoring in the Nile Basin. The stakeholder analysis of the Nile Basin District and this study have shown that there are, already, a multitude of stockholders related to plastic monitoring in the 10 Nile riparian states, with a total of 495 stakeholders from the public, private, academic, and civil society sectors. However, the stakeholders are not distributed evenly across countries and sectors, with a particularly high number of stakeholders in the upper Nile basin and in the civil society sector.

On the one hand the results of the survey reveal multi-dimensional capacity challenges regarding plastic monitoring in the Nile basin. First, answers related to the enabling environment have indicated that factors typically enabling good governance are rather missing in the Nile basin. Second, for the implementation of monitoring and data handling the situation related to knowledge and skills is better (somewhat lacking) compared to the availability of financial and technical resources (fully lacking). Third, communication questions have shown that awareness and information both at national and at international scale is very low, with some variation between sectors and countries.

The analysis of gender-specific aspects showed that 75% of the survey respondents were male, while only 25% were female. The findings revealed no significant differences between male and female respondents in their perceptions of capacities, resources, and other factors related to macroplastic monitoring. Both genders provided similar assessments of the enabling environment, monitoring processes, and communication. There were only two notable differences: male respondents in academia and in Tanzania reported higher levels of information sharing than their female counterparts.

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Annexes

Table A2.1: List of scientific studies

Name	Country	Water-body	Method	Authors	DOI	ID
Can Tho	Vietnam	River	visual counting	van Calcar et al. (2019)	https://doi.org/10.1088/1748-9326/ab5468	1
Chao Praya	Thailand	River	visual counting	van Calcar et al. (2019)	https://doi.org/10.1088/1748-9326/ab5468	1
Pahang	Malaysia	River	visual counting	van Calcar et al. (2019)	https://doi.org/10.1088/1748-9326/ab5468	1
Kuantan	Malaysia	River	visual counting	van Calcar et al. (2019)	https://doi.org/10.1088/1748-9326/ab5468	1
Rach Cai Khe	Vietnam	River	visual counting	van Calcar et al. (2019)	https://doi.org/10.1088/1748-9326/ab5468	1
Ciliwung	Indonesia	River	visual counting and sampling using bridge-mounted trawls	van Emmerik et al.	https://doi.org/10.1088/1748-9326/ab30e8	2
Jones Falls	USA	River	trash collection device (Mr. Trashwheel)	Lindquist (2016)	https://www.thejot.net/archive-issues/?id=51	3
Meycuayan	Philippines	River	visual counting	van Emmerik et al. (2020)	https://doi.org/10.3389/fmars.2020.545812	4
Pasig	Philippines	River	visual counting	van Emmerik et al. (2020)	https://doi.org/10.3389/fmars.2020.545812	4
Tullahan	Philippines	River	visual counting	van Emmerik et al. (2020)	https://doi.org/10.3389/fmars.2020.545812	4
Motagua	Guatemala	River	visual counting	Meijer et al. (2020)	https://doi.org/10.6084/m9.figshare.13370954.v1	5
Rio Motagua	Guatemala	River	visual counting	Meijer et al. (2020)	https://doi.org/10.6084/m9.figshare.13370954.v1	5
Pesanggrahan	Indonesia	River	visual counting	van Emmerik et al. (2020)	https://doi.org/10.1038/s41598-019-50096-1	6
Saigon	Vietnam	River	visual counting	van Emmerik et al. (2019)	https://doi.org/10.1038/s41598-019-50096-1	6
Rhine	Netherlands	River	visual counting and trash collection device (Shoreliner)	Vriend et al. (2020)	https://doi.org/10.3389/fmars.2020.00010	6
Rhone	France	River	visual counting	Castro-Jimenez et al. (2019)	https://doi.org/10.1016/j.marpolbul.2019.05.067	7
Seine	France	River	visual counting	van Emmerik et al. (2019)	https://doi.org/10.3389/fmars.2019.00642	8
Tiber	Italy	River	visual counting	Crosti et al. (2018)	https://doi.org/10.1007/s12210-018-0747-y	9

Eems	Germany	River	visual counting and River bank sampling	Schoeneich-Argent et al. (2020)	https://doi.org/10.1016/j.envpol.2020.114367	11
Weser	Germany	River	visual counting and River bank sampling	Schoeneich-Argent et al. (2020)	https://doi.org/10.1016/j.envpol.2020.114367	11
Elbe	Germany	River	visual counting and River bank sampling	Schoeneich-Argent et al. (2020)	https://doi.org/10.1016/j.envpol.2020.114367	11
Llobregat	Spain	River	visual counting	Schirinzi et al. (2020)	https://doi.org/10.1016/j.scitotenv.2020.136807	12
Besos	Spain	River	visual counting	Schirinzi et al. (2020)	https://doi.org/10.1016/j.scitotenv.2020.136807	12
Aichi	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Akita	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Aomori	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Chiba	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Ehime	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Fukui	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Fukuoka	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Fukushima	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Hiroshima	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Hokkaido	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13

Hyogo	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Ibaraki	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Ishikawa	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Iwate	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Kagawa	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Kagoshima	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Kanagawa	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Kochi	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Kumamoto	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Kyoto	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Mie	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Miyagi	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Miyazaki	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13

Nagasaki	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Niigata	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Oita	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Okayama	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Okinawa	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Osaka	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Saga	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Shimane	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Shizuoka	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Tokushima	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Tokyo	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Tottori	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Toyama	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13

Wakayama	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Yamagata	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Yamaguchi	Japan	River	indirect estimate from microplastic concentrations	Nihei et al. (2020)	https://doi.org/10.3390/w12040951	13
Odaw River	Ghana	River	visual counting	Pinto et al. (2024)	https://doi.org/10.1016/j.marpolbul.2023.115813	14
Sundays River	South Africa	River	visual counting	Moss et al. (2021)	https://doi.org/10.1016/j.marpolbul.2020.111876	15
Swartkops River	South Africa	River	visual counting	Moss et al. (2021)	https://doi.org/10.1016/j.marpolbul.2020.111876	15
Baakens River	South Africa	River	visual counting	Moss et al. (2021)	https://doi.org/10.1016/j.marpolbul.2020.111876	15
Mvudi River	South Africa	River	manual sampling river and bank	Mashamba et al. (2024)	https://doi.org/10.1007/s10661-024-12409-4	16
Nandoni reservoir	South Africa	River	bank survey	Dalu et al. (2019)	https://doi.org/10.1016/j.scitotenv.2019.133992	17
Lake Victoria	Uganda	River	bank survey and sediment sampling	Egessa et al. (2020)	https://doi.org/10.1016/j.envpol.2019.113442	18
Tiber	Italy	River	Riparian vegetation survey	Galitelli et al. (2024)	http://dx.doi.org/10.1016/j.envres.2024.120224	19
Farfa	Italy	River	Riparian vegetation survey	Galitelli et al. (2024)	http://dx.doi.org/10.1016/j.envres.2024.120224	19
Aniene	Italy	River	Riparian vegetation survey	Galitelli et al. (2024)	http://dx.doi.org/10.1016/j.envres.2024.120224	19
Marta	Italy	River	Riparian vegetation survey	Galitelli et al. (2024)	http://dx.doi.org/10.1016/j.envres.2024.120224	19
Mignon	Italy	River	Riparian vegetation survey	Galitelli et al. (2024)	http://dx.doi.org/10.1016/j.envres.2024.120224	19
Arrone	Italy	River	Riparian vegetation survey	Galitelli et al. (2024)	http://dx.doi.org/10.1016/j.envres.2024.120224	19
Nakasuka Waterway	Japan	River	Camera survey water surface	Kataoka et al. (2024)	http://dx.doi.org/10.3389/feart.2024.1427132	20
Shigenobu River	Japan	River	Camera survey water surface	Kataoka et al. (2024)	http://dx.doi.org/10.3389/feart.2024.1427132	20

Ishite River	Japan	River	Camera survey water surface	Kataoka et al. (2024)	http://dx.doi.org/10.3389/feart.2024.1427132	20
North Branch of the Chicago River	USA	River	Collection of material from floating debris rafts	Hoellein et al. (2024)	http://dx.doi.org/10.1002/wer.11116	21
Danube	Romania	River	Net sampling	Procop et al. (2024)	http://dx.doi.org/10.1186/s12302-024-00969-8	22
Hamada River	Japan	River	Bank survey	Chowdhury et al. (2023)	http://dx.doi.org/10.1007/s11270-023-06799-3	23
Mahiga Creek	Philippines	River	visual counting	Bardenas et al. (2023)	https://doi.org/10.1016/j.marpolbul.2023.115197	24
Têt River	France	River	visual counting	Laverre et al. (2023)	http://dx.doi.org/10.1016/j.scitotenv.2023.162733	25
Cara River	Brazil	River	visual counting	Rosa et al. (2023)	http://dx.doi.org/10.1016/j.marpolbul.2023.114757	26
Guamá River	Brazil	River	visual counting	Rosa et al. (2023)	http://dx.doi.org/10.1016/j.marpolbul.2023.114757	26
Dunajec River	Poland	River	Bank survey	Liro et al. (2022)	http://dx.doi.org/10.1016/j.scitotenv.2022.156354	27
Ganges	India	River	Urban Area sampling	Youngblood et al. (2022)	http://dx.doi.org/10.1021/acs.est.1c04781	28
Mekong Delta	Vietnam	River	River Bottom Trawl	Karpova et al. (2022)	http://dx.doi.org/10.1016/j.envpol.2021.118747	29
Kifissos River estuary	Greece	River	Collection Device	Gkanasos et al. (2021)	http://dx.doi.org/10.3389/fmars.2021.738876	30
Guadalete river	Spain	River	Accoustic sounding	Broere et al. (2021)	http://dx.doi.org/10.3389/feart.2021.628704	31
Seine	France	River	Bank survey	Tramroy et al. (2021)	http://dx.doi.org/10.1016/j.marpolbul.2021.112513	32
Saigon River	Vietnam	River	floating debris collection	Lahens et al. (2018)	http://dx.doi.org/10.1016/j.envpol.2018.02.005	33
Tullahan River	Phillipines	River	visual counting and float method	Talavera et al. (2024)	http://dx.doi.org/10.3389/fenvs.2024.1396525	34
Meuse	Netherlands	River	Bank survey	Hauk et al. (2023)	http://dx.doi.org/10.1088/1748-9326/ad0768	35
Rhine	Netherlands	River	trawl nets	Vriend et al. (2023)	http://dx.doi.org/10.1016/j.scitotenv.2023.165716	36
Aniene River	Italy	River	riparian vegeation survey	Gallitelli and Scalici (2023)	http://dx.doi.org/10.1016/j.ecolind.2023.110531	37
Santa Ana River, California	USA	River	trawl nets	Cowger et al. (2022)	http://dx.doi.org/10.1016/j.ejrh.2022.101264	38

Surma River system	Bangladesh	River	bank survey	Abdullah et al. (2022)	http://dx.doi.org/10.3390/w14203263	39
Road site ditches, New York State	USA	River	manual sampling	Pietz et al. (2021)	http://dx.doi.org/10.1016/j.jenvman.2021.113524	40
Klang River	Malaysia	River	visual counting	van Emmerik et al. (2020)	http://dx.doi.org/10.3389/feart.2020.00298	41
Seine	France	River	bank survey	Tramroy et al. (2020)	http://dx.doi.org/10.1016/j.marpolbul.2020.110894	42
Multiple rivers and lakes	Switzerland	River and Lake	bank survey	Schreyers et al. (2024)	http://dx.doi.org/10.1016/j.envpol.2024.124911	43
Deer Creek near Saint Louis , MO	USA	River	Stream sampling, bank survey	Hernandez et al. (2024)	http://dx.doi.org/10.1089/ees.2024.0106	44
Ijssel	Netherlands	River	bank survey, sediment sampling, trawl nets	Schreyers et al. (2024)	http://dx.doi.org/10.1016/j.watres.2024.121786	45
Waal	Netherlands	River	bank survey, sediment sampling, trawl nets	Schreyers et al. (2024)	http://dx.doi.org/10.1016/j.watres.2024.121786	45
Ave River	Portugal	River	bank survey	Pace et al. (2024)	http://dx.doi.org/10.1016/j.envpol.2024.123528	46
Selho River	Portugal	River	bank survey	Pace et al. (2024)	http://dx.doi.org/10.1016/j.envpol.2024.123528	46
Thames	Great Britain	River	trawl nets	McGoran et al. (2023)	http://dx.doi.org/10.1016/j.envpol.2023.122484	47
Mekong-Tonle Sap-Bassac river system	Cambodia	River	net sampling and visual counting	van Emmerik et al. (2023)	http://dx.doi.org/10.3389/fenvs.2023.1173946	48
Laurentian Great Lakes	Canada/USA	Lake	bank sampling	Arturo and Corcoran (2022)	http://dx.doi.org/10.1088/1748-9326/ac5714	49
Huveaune River	France	River	Collection device (bar screens)	Tramroy et al. (2022)	http://dx.doi.org/10.1016/j.wasman.2022.01.015	50
Parana River	Argentina	River	Bank survey	Garello et al. (2021)	http://dx.doi.org/10.1016/j.envpol.2021.118168	51
Saigon River	Vietnam	River	Visual Counting, UAV survey	Schreyers et al. (2021)	http://dx.doi.org/10.3389/fenvs.2021.686334	52
Parana River	Argentina	River	Bank survey	Mitchell et al. (2021)	http://dx.doi.org/10.1007/s11356-020-11686-z	53

Lake Tollense	Germany	Lake	Bank survey	Hengstmann and Fischer (2020)	http://dx.doi.org/10.1016/j.envres.2020.109945	54
Meuse	Netherlands	River	Bank survey	Kuizenga et al. (2023)	http://dx.doi.org/10.3389/fenvs.2023.1180872	55
Rhine	Switzerland	River	visual counting	Kuizenga et al. (2023)	http://dx.doi.org/10.3389/fenvs.2023.1180872	55
Rhine	Germany	River	visual counting	Kuizenga et al. (2023)	http://dx.doi.org/10.3389/fenvs.2023.1180872	55
Rhine	Netherlands	River	visual counting	Kuizenga et al. (2023)	http://dx.doi.org/10.3389/fenvs.2023.1180872	55
Rhine-Measue Delta	Netherlands	River	visual counting	van Emmerik et al. (2022)	http://dx.doi.org/10.1029/2022EF002811	56
Lake Markakol	Kazakhstan	Lake	trawl nets	Madibekov et al. (2024)	http://dx.doi.org/10.3390/app14188460	57
Urban Streams in Baltimore and Chicago	USA	River	collection device	Hoellein et al. (2024)	http://dx.doi.org/10.1086/729305	58
Waal	Netherlands	River	bank survey	Grosfeld et al. (2024)	http://dx.doi.org/10.1016/j.marpolbul.2024.116110	59
Rhine-Meuse delta	Belgium	River	trawl nets	Blondel and Buschman (2022)	http://dx.doi.org/10.3389/fenvs.2022.861457	60
Mill Creek, Atlanta, Georgia	USA	River	manual sampling	Poletti and Landberg (2021)	http://dx.doi.org/10.1086/716214	61
Tamsui River	Taiwan	River	bank survey	Scheneider et al. (2021)	http://dx.doi.org/10.3390/su13168765	62
Rhine-Meuse delta	Belgium	River	bank survey	van Emmerik et al. (2020)	http://dx.doi.org/10.1088/1748-9326/abb2c6	63
Tamandaré River	Brazil	River	visual counting	Rosa et al. (2024)	http://dx.doi.org/10.1016/j.envpol.2024.125279	64
Tucunduba River	Brazil	River	visual counting	Rosa et al. (2024)	http://dx.doi.org/10.1016/j.envpol.2024.125279	64
Tisza River	Serbia	River	Bank survey	Monar et al. (2024)	http://dx.doi.org/10.3390/su16125040	65
Waal	Netherlands	River	trawl nets	Oswald et al. (2023)	http://dx.doi.org/10.1016/j.scitotenv.2023.162827	66
Dvina Rivers	Russia	River	visual counting	Mikusheva et al. (2023)	http://dx.doi.org/10.3390/jmse11020293	67
Onega River	Russia	River	visual counting	Mikusheva et al. (2023)	http://dx.doi.org/10.3390/jmse11020293	67
Themi River	Tanzania	River	bank survey	Kundu et al. (2021)	http://dx.doi.org/10.1007/s00244-021-00897-1	68

Burka River	Tanzania	River	bank survey	Kundu et al. (2021)	http://dx.doi.org/10.1007/s00244-021-00897-1	68
Naura River	Tanzania	River	bank survey	Kundu et al. (2021)	http://dx.doi.org/10.1007/s00244-021-00897-1	68
Kijenge River	Tanzania	River	bank survey	Kundu et al. (2021)	http://dx.doi.org/10.1007/s00244-021-00897-1	68
Warnow River	Germany	River	trawl nets, bank survey	Schernewski et al. (2021)	http://dx.doi.org/10.1007/s00267-021-01534-2	69
Rivers Jakarta	Indonesia	River	bridge mounted camera	van Lieshout et al. (2020)	http://dx.doi.org/10.1029/2019EA000960	70

A3.1—-List of References from academic stakeholders related to water and plastic in the Nile Basin. See also Table 3.1

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Table: A3.2. Stakeholder visited during the scoping mission in September 2024

Organisation	Country
The National Fisheries resources research institute (NaFIRRI), Jinja	Uganda
City Council Jinja, Department of Environment	Uganda
National Water Works, Jinja	Uganda
Lake Victor Basin Commission, Kisumu	Kenya
Water Resources Association (Lake Victoria South Basin), Kisumu	Kenya
Kisumu Water and Sanitation Company (KIWASCO), Kisumu	Kenya
Material Recovery Facility, Kisumu	Kenya
NEMA, Kisumu County Office, Kisumu	Kenya
Friends of Lake Victoria (OSIENALA), Kisumu	Kenya
City of Kisumu, Department of Environment	Kenya
Uganda Junior Rangers(One Earth One Ocean), Kampala	Uganda

ONE RIVER
ONE PEOPLE
ONE VISION

Nile Basin Initiative Secretariat
P.O. Box 192
Entebbe – Uganda
Tel: +256 414 321 424
+256 414 321 329
+256 417 705 000
Fax: +256 414 320 971
Email: nbisec@nilebasin.org
Website: http://www.nilebasin.org

/Nile Basin Initiative
@nbiweb

Eastern Nile Technical Regional Office
Dessie Road
P.O. Box 27173-1000
Addis Ababa – Ethiopia
Tel: +251 116 461 130/32
Fax: +251 116 459 407
Email: entro@nilebasin.org
Website: http://ensap.nilebasin.org

ENTRO

Nile Equatorial Lakes Subsidiary Action Program Coordination Unit
Kigali City Tower
KCT, KN 2 St, Kigali
P.O. Box 6759, Kigali Rwanda
Tel: +250 788 307 334
Fax: +250 252 580 100
Email: nelsapcu@nilebasin.org
Website: http://nelsap.nilebasin.org

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