Citizen Science
data integration

SDG 6.3.2

Summary report on process and lessons learnt

earthwatch EUROPE
FreshWaterWatch Powered by earthwatch EUROPE
KENAWRUA
WRA WATER RESOURCES AUTHORITY
miniSASS
GroundTruth environment & engineering
Drinkable Rivers
UN environment programme
GEMS Water
WWQA World Water Quality Alliance

Data integration project process

- The project was coordinated by GEMS/Water and Earthwatch Europe .
- The proposal gave a clear outline of project activities, which were confirmed in bilateral agreements between Earthwatch Europe, as contracted lead with WWQA, and the other partners.
- Monthly meetings were held with all partners to ensure clarity about the plans and progress. Meetings were also set up between relevant partners focussed on each ACTIVITY.
- The priority in the first month was to contract and distribute funds, as well as ship Freshwater Watch kits. It was also important to understand the format of the existing Kenyan data.
- Attention then moved to transcription of historical data, development of the Freshwater Watch platform and training sessions, as well as planning for the Workshop delivery.
- Finally the project team worked on uploading the historical data, working with local communities to collect new FreshWater Watch data and delivery of the Workshop to discuss data integration. Additionally work was done to visualise the data sources together.
- Good communication between partners was key to the success of the project, especially considering that participants were all spread across different countries – Kenya, Ireland, Italy, South Africa, UK, The Netherlands.

Lessons Learnt: South Africa

- **Training delivery:** Based on training participant feedback, in-person and practical training is preferred over online training sessions. This is a limitation for scaling, given that in-person training of the number and geographic spread of people involved in the South African case study would not be possible. However, online training was successful enough that all the teams and individuals that attended were able to successfully capture good data. Follow up training sessions and support would increase data accuracy and confidence of participants.

- **Digital support of citizens:** Citizen scientists in South Africa exhibit a wide range of digital literacy levels, as well as access to digital media and devices. Reaching rural communities and those who might benefit most from shared knowledge generation about their water resources can be excluded from online training or platforms that require digital devices for data capture. In the South African case study, several of the older participants experienced challenges with the complexity of the entire process, from attending online training, to downloading the app, registering across platforms, using the app to collect data, data submission, and eventually to viewing their data. This links to the participant feedback regarding video tutorials to take a new participant through everything step-by-step to help overcome and digital literacy barriers. However, trainers were available to provide support, which meant that all participants eventually engaged with data collection and successfully contributed to the research project.

- **Equipment thresholds**: A major impact on the health of South African river systems is the discharge of wastewater effluent from wastewater treatment works which are not meeting operating standards, as well as wastewater not reaching wastewater treatment works because of failing sewage reticulation networks. Where there are extreme problems with sewage pollution, which is common in stream and river reaches located in and around most human settlements, the upper end of the measurable limit of the Freshwater Watch kits for nitrates and phosphates is below the real concentration. Participants wanting to see an estimate of actual nutrient concentrations are only able to see that the concentration is >1.0 mg/L. This indicates a severe nutrient loading issue, though participants learned that to get more accurate concentrations they would need to send water samples to laboratories for measurement. For citizen science groups not wanting to simply get concentration estimates of >1.0mg/L, sample design strategies should account for pollution sources and sample upstream or far enough downstream to get nutrient concentrations within the measurable scale.

- **Data visualisation:** Participants were interested in using the ArcGIS Survey123 platform to view and analyse their results, especially those who have a professional background in water resources monitoring and are interested in learning more about the applications of citizen science in this space. Therefore, a note for citizen science monitoring and data integration is to ensure that data are not only findable, accessible, interoperable, and reusable (FAIR), but summarised and visualised in an intuitive way. This allows for the participants to visualise their data and see how it relates to other data being collected across the globe. Intuitive feedback and data accessibility are critical to participant engagement, especially return engagement, which is typically one of the most difficult challenges to citizen science initiatives.

Lessons Learnt: Kenya

- **Empowerment through Engagement:** Involving local communities and WRUAs in water quality monitoring fosters greater awareness and a sense of stewardship over water resources, thereby enhancing their commitment to sustainable basin management.
- **Data Completeness and Accuracy**: Collaborative efforts between WRA and WRUAs and community scientists can improve the geographic and temporal coverage of water quality data. Training community members in standardized data collection methods is essential for ensuring the accuracy and reliability of the information gathered.
- **Enhanced Decision-Making**: The integration of diverse datasets from WRUAs provides a more comprehensive view of water quality, enabling better-informed decision-making for water resource management, policy formulation, and conservation strategies.
- **Strengthening Networks:** Building strong relationships among WRUAs, local authorities, and community scientists enhances communication and facilitates the sharing of resources, expertise, and data, ultimately leading to more effective basin management.
- **Utilization of Technology:** Employing digital tools and platforms for data collection, analysis, and reporting can streamline the monitoring process and improve accessibility. This technology-driven approach can also aid in real-time data sharing, attracting more stakeholders to participatory water management.
- **Alignment with National and Global Goals:** Integrating citizen science data into the frameworks for reporting on SDG 6.3.2 underscores the importance of grassroots contributions to global water quality assessments, promoting accountability and support for local initiatives.
- **Adaptive Management:** The dynamic nature of water resources necessitates an adaptive management approach. Continuous data collection from both WRUAs and community scientists allows for real-time adjustments in management strategies based on emerging trends and water quality issues.
- **Capacity Building:** Ongoing training and capacity-building initiatives strengthen the skills of both WRUAs and community members in data collection, analysis, and interpretation, which enhances the overall quality of management strategies over time.

Lessons Learnt: FreshWater Watch Platform

There is real interest in the functionality and what it could be use for: Working together with new partners has worked well with very productive discussions meaning the work needed to the platform was able to be carried out efficiently.

Time and effort of data processing: Preparing the historical data provided and ensuring thorough data validation was time consuming, especially given the data was in different formats across multiple years. This was critical to meet the data requirements of the existing system. Ideally original data owners would share the data in a template to ensure they are able to confirm the data themselves.

Innovation by working in new ways: New services on the platform were developed to ensure straight-forward and accurate data entry i.e. displaying only the sites list linked to the username, rather than a free text entry. This was implemented and tested and improved to allow multiple users to be able to upload data to a single site if the request appeared in the future. A map was also developed showing FreshWater Watch data and WRUA data – combining the data within the platform. This has not been done before and is a fantastic output of the project.

Team capacity across partners: It was sometimes challenging to coordinate between partners when one relied on the other completing tasks in order to move to the next stage. Those completing the work had other projects they were working on or travel plans and sometimes there were delays as calendars did not align. It would be good to check this more closely even during proposal stage.

Overall

The project has enabled the partners to consider the challenges and opportunities of data integration of citizen science water quality data for SDG6.3.2.

The workshop was a useful way to engage with wider stakeholders to consider their opinions and suggestions.

Working together has developed a strong foundation for enabling more data integration in the future.