ECOLOGICAL MONITORING

Local government contributions to improved river ecological monitoring

Chantel Petersen, Swastika Surujlal-Naicker and Shadley Mackenzie report on the City of Cape Town's river ecological monitoring programme.

Sustaining water-related ecosystems in urban rivers is critical to improved living conditions in cities. The world has already lost 70% of its water-related ecosystems, which is crucial for sustainable development (Xu et al., 2019). Effective monitoring programmes are essential to understand urban river quality and the impacts of pollution on its ecosystems.

In South Africa, a progressive decline in the extent and integrity of national monitoring programmes was noted as one of the main conclusions in the Water Research Commission (WRC) funded study in 2012, 'The freshwater science landscape in South Africa, 1900-2010' (Ashton et al. 2012). Ashton et al. (2012) further stated that due to the lack of appropriate skills in the aquatic sciences, the number of water quality sites monitored had declined, with a decrease in parameters being analysed and a decrease in sampling frequency, hampering the management of water resources. The reducing trend in water monitoring has been occurring at the same time as a general decrease in water quality. The study called for expanding monitoring efforts and a focused effort in training strong, decisive scientific leaders in aquatic science.

Four years later, Impson (2016) suggested that the minimum ideal capacity of aquatic scientists required within provincial government departments managing inland waters as a mandate in coastal provinces should be eight and six for inland provinces. These should include fish, wetland, river, and estuarine scientists with qualifications ranging from a Master's to a Doctorate. However, at the time of the assessment, only one province in South Africa had the minimum complement of

eight aquatic scientists (Impson, 2016). Van Deventer et al. (2019) showed that the water quality monitoring network (surface and groundwater) of the National Department of Water and Sanitation (DWS) was severely underfunded during 2018/19, with the consequent result that less than 40% of the surface and groundwater monitoring sites sampled nationally were analysed (van Deventer et al. 2019) illustrating that the downward trend reported by Ashton et al. (2012) continues. Similar challenges are also experienced in local municipalities.

The City of Cape Town has recognised the shortcomings and the need to understand freshwater ecosystems as part of a multidisciplinary system holistically. The metropolitan municipality has a role in achieving the 2030 Agenda for Sustainable Development Goals (SDGs) targets as outlined in the Integrated Development Plan (IDP) July 2022 to June 2027. Among the SDGs relating to water and sanitation are SDG 11, where target 11.6 aims to reduce cities' environmental impact, especially related to air quality, municipal and other waste management. SDG 6, target 6.3 aims to improve water quality by reducing pollution, eliminating dumping, minimising the release of hazardous chemicals and materials, minimising the proportion of untreated wastewater, and increasing recycling and safe reuse (UN, 2020). The IDP outlines how the municipality will contribute to the SDGs with various programmes and initiatives (IDP, 2022-2027). Monitoring the water sector is essential to achieve the objectives of these initiatives, as it is impossible to manage a resource without measuring it (Ashton et al. 2012).

In the Water and Sanitation Directorate, the Scientific Services Branch has subsequently expanded its capacity in the aquatic sciences with disciplines in freshwater ecology, fluvial geomorphology and groundwater. The City employs Infrastructure and Skills Development Grant (ISDG) graduates funded by the National Department of Treasury on three-year contracts. The most recent intake included graduates with Honours and Master's degrees in geohydrology and fluvial geomorphology, with the possibility of acquiring these skills in permanent positions. Some graduates are pursuing Master's and PhD degrees within the ISDG programme.

Water quality monitoring in the City of Cape Town

The City of Cape Town, through the Scientific Services Branch, monitors a vast array of water quality types, including natural freshwater such as rivers and vlei areas, groundwater, stormwater, potable water, wastewater, treated effluent, industrial effluent, and coastal water quality throughout the city boundaries. The freshwater ecosystem sample sites are located in 20 major river catchments (Figure 1), which amounts to more than 150 inland river points, five recreational vleis, and other minor wetlands sampled for water quality monthly.

In addition to physicochemical, microbiological and hydrobiological (algae and toxicity) analyses of the rivers, vleis and wetlands, the ecological condition of river sites is also assessed using the South African Scoring System version 5 (SASS5) rapid biomonitoring method. The method was introduced to the metro's water quality monitoring programme in 2000, following the broad-scale introduction of the assessment with the DWS National River Health Programme (now known as the River Ecosystem Monitoring Programme – REMP).

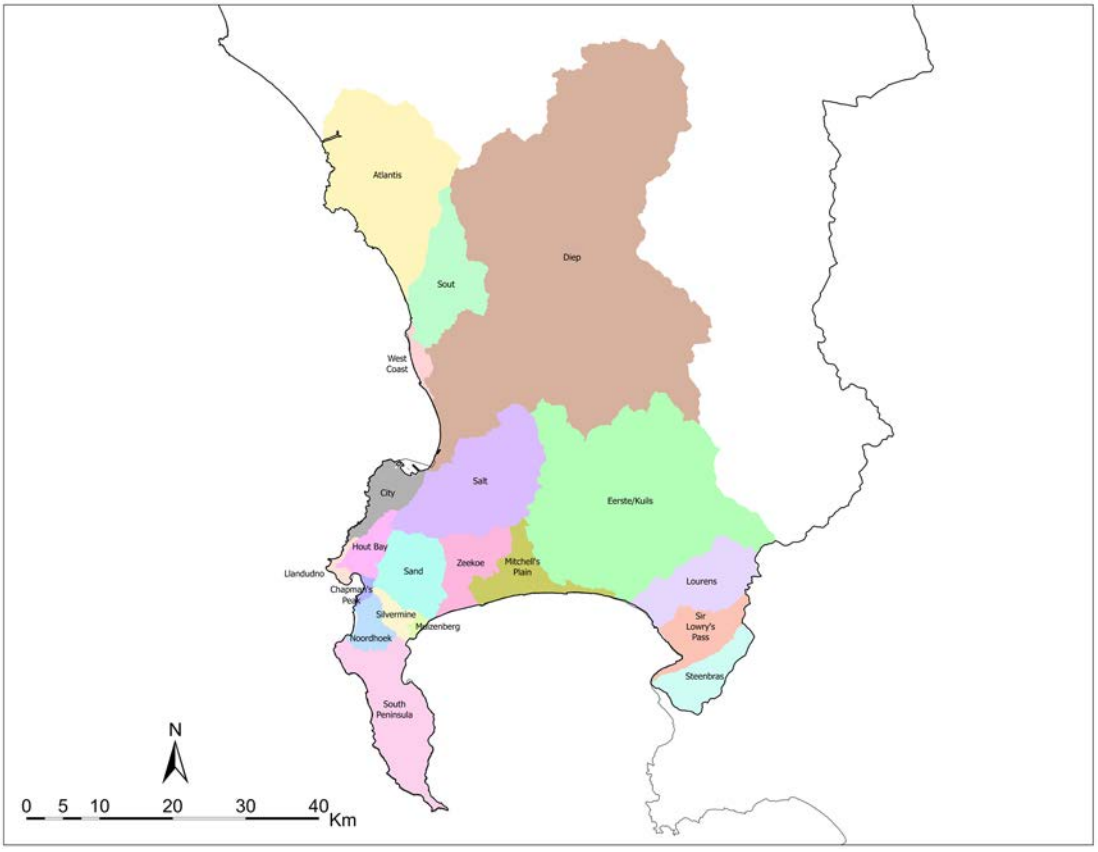

Figure 1. Major river catchments in the City of Cape Town.

Figure 2. City of Cape Town biomonitoring team training and sampling using the SASS5 method.

The biomonitoring programme has faced challenges, with more than 80 biomonitoring river sites across the City of Cape Town requiring quarterly (seasonal) sampling. To improve on the seasonal biomonitoring programme, capacity building in the SASS5 method occurred within the Scientific Services Branch. Staff attended the short course offered by the Freshwater Consulting Group in Cape Town in February 2023 to achieve accreditation in the method. Following course attendance, intensive SASS5 training continued with previously accredited SASS5 practitioners within the City training staff new to the technique (Figure 2) in preparation for the accreditation testing offered by DWS. Subsequently, all ten staff successfully obtained accreditation in the SASS5 method. With this many practitioners in the organisation, seasonal sampling of all 80+ biomonitoring sites will be possible since more sites can be sampled by more than one team.

The value of biomonitoring data

Biomonitoring sites are located at point sources of pollution and at reference sites and sites throughout the river length to indicate the ambient water quality throughout the city rivers. Relating biomonitoring data with traditional physicochemical water quality analysis will improve the correlation between water quality and ecological river conditions. The programme also provides baseline macroinvertebrate and habitat data before the commencement of the City's river and wetland rehabilitation plans, such as the Liveable Urban Waterway (LUW) project in some of the City river catchments.

The LUW project will focus on collaboration and water-sensitive design management in line with commitments made in the City's Water Strategy in 2019 (City of Cape Town, 2019; City of Cape Town, 2021; Mathews, 2023). The improvement in ecological monitoring by the City can also benefit national-scale projects and objectives where long-term monitoring data is essential, such as reporting on river ecological conditions to the National Biodiversity Assessments, which are led by the South African National Biodiversity Institute (SANBI). The reference sites where biomonitoring occurs are also in strategic water source areas. Long-term macroinvertebrate data in these areas can assist in identifying trends linked to a changing climate that will negatively affect these important water provision areas, which can trigger mitigation planning.

With many government departments lacking capacity, the way forward is collaboration and partnerships for knowledge co-production. The Scientific Services Branch has embarked on establishing several collaborations and Memorandums of Agreements with government departments, water utilities, academic institutions, parastatals, and the like with the aim of cooperation and scientific information sharing.

References

- Ashton P.J., Roux, D.J., Breen, C.M., Day, J.A., Mitchell, S.A., Seaman, M.T. and Silberbauer, M., 2012. The freshwater science landscape in South Africa, 1900-2010. Overview of research topics, key individuals, institutional change and operating culture. Water Research Commission Report Number, TT 530/12, Pretoria, South Africa. https://www.wrc.org.za/wp-content/uploads/mdocs/TT%20530-12.pdf
- City of Cape Town 2019. Our shared water future. Cape Town's Water Strategy. https://resource.capetown.gov.za/documentcentre/Documents/City%20strategies,%20plans%20and%20frameworks/Cape%20Town%20Water%20Strategy.pdf
- City of Cape Town (2021). Liveable Urban Waterways Implementation Framework. Water and Sanitation, Resilience, Environmental Management, Urban Planning and Design, Recreation and Parks Departments.
- City of Cape Town (2022-2027). Integrated Development Plan (IDP): New Term of Office. https://resource.capetown.gov.za/documentcentre/Documents/City%20strategies%2C%20plans%20and%20frameworks/IDP_2022-2027.pdf
- Impson, D. 2016. 'Have our provincial aquatic become critically endangered?', The Water Wheel, September/October, p. 20–23. https://journals.co.za/doi/pdf/10.10520/EJC195883
- Matthews, S. 2023. Restoring the ecological health of Cape Town's waterways – one vlei at a time. The Water Wheel, May/June, p. 20–23. https://journals.co.za/doi/pdf/10.10520/ejc-waterb-v22-n3-a5
- U.N. (United Nations). (2020). The Sustainable Development Goals report. https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf
- Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. & Van der Colff, D. 2019. South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.
- Zuxin, X., Wei, J. and Jin X. (2019). Making cities sustainable through rehabilitating polluted urban rivers: Lessons from China and other developing countries. United Nations Human Settlements Programme (UN-Habitat). https://unhabitat.org/sites/default/files/2020/11/making_cities_sustainable_through_rehabilitating_polluted_urban_rivers.pdf.