

Report :

Water quality and E. coli Levels in the Groot River Estuary, Nature's Valley 2023

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Rationale

The southern Cape region of South Africa is home to a diverse array of rivers and estuaries that play a crucial role in supporting local ecosystems and communities. Given that South Africa is an arid country with an average rainfall far below the global average, the level of freshwater supply to water systems such as these rivers and estuaries is low. These systems, though, are known as biodiversity hotspots with estuaries, in particular, providing important habitats for many species. However, given their importance to society, these systems are also subject to intense human pressure. When combined with the impacts of climate change, this scenario is bound to cause a decline in water quality.

The southern Cape waterways, including the Groot (West) River, are characterized by their unique ecological features, including rich biodiversity and important habitat for various species of fish, birds, and plants. NVT is actively involved in research and conservation efforts focused on the Salt and Groot rivers and estuaries. This research includes monitoring water quality, studying the impacts of invasive species on native flora and fauna, and assessing the ecological health of these vital ecosystems. By conducting research and implementing targeted conservation measures, it is aimed to protect and restore these southern Cape rivers and estuaries, ensuring their long-term sustainability and the preservation of their valuable natural resources.

The Groot River is a cherished natural resource in the southern Cape of South Africa. Its beauty, ecological significance, and recreational opportunities make it a notable part of the region's natural heritage, deserving of conservation efforts to preserve its unique features for future generations. Monitoring this river is of paramount importance in understanding and safeguarding the health of critical ecosystems. The Groot (West) River Estuary is a temporary open-close system that becomes closed at the mouth with the formation of a sand bar, cutting the estuary off from the sea. Nature's Valley Trust in collaboration with Bitou Municipality, SANParks and Garden Route District Municipality, conduct sampling and collate data collected in a Groot River Estuary Monitoring Project. The monitoring project consists of monthly sampling of water quality at fixed localities throughout the Estuary which have been determined based on major drainage points and potential points of influence (Appendix A). Monitoring areas looked at are: mouth status, Temperature (°C), Salinity (ppt), pH, Oxygen (%), Oxygen (mg/l), and *Escherichia coli* (*E. coli*) counts. The project builds on water quality data previously collected during the Groot River Estuary Fish Project in collaboration with SANParks. This data included selected parameters such as temperature (°C), Salinity (ppt), pH, Oxygen (%), and Oxygen (mg/l). The fish community of the estuary was previously monitored on a quarterly basis in a collaborative project between SANParks and the Nature's Valley Trust has since concluded and is being written up into scientific reports. Hotspot areas are inspected for signs of sewage pollution. Regular monthly waterbird counts are also conducted during water quality monitoring throughout the estuary,

contributing to Coordinated Waterbird Counts (CWAC) data that is readily available and is open access on the UCT website. Data collected on a monthly basis from NVT, Bitou Municipality, SANParks, and the Garden Route District Municipality is collated into an online spreadsheet which is then reported on quarterly.

This monitoring assesses how mouth dynamics and rising estuary levels are affected by the development within and around Nature's Valley, this referring to the sewage outlets, septic tanks, freshwater abstraction above the Groot River bridge, and artificial breaching of the estuary mouth which affect the natural breaching process and salinity regime of the estuary. Under normal conditions the water may cause the Nature's Valley access road, waterfront properties gardens, estuary mouth parking area and the SANParks rest-camp to become partially inundated. The Groot River Estuary is currently classified as a category B estuary on the NBA. As such, and according to the standards set out in the National Estuarine Management Protocol, the estuary has to be managed to, as a minimum, maintain this ecological classification. The estuary being situated within a national park is further reason to continue to manage. If monitoring does not occur and the mouth is left to breach naturally there will be significant issues that could arise from sewage contamination (due to lowly situated septic tanks), potential expansion on other forms of pollution, flooding, salinity intrusion into the water abstraction site, all of which pose a health risk to the public.

Monthly bird counts are conducted in and around the Groot River and its estuary to determine the system's life-supporting potential. This data is fed into the citizen science platform CWAC (coordinated waterbird count) hosted by the University of Cape Town to add to the long-term database for the area – a database that stretches over 15 years. These surveys help identify important feeding, breeding, and resting areas for waterbirds, providing vital information for habitat conservation and management. By monitoring waterbird populations, researchers can also detect changes in their abundance and behavior, serving as indicators of the overall ecological health of this ecosystem. Overall, the bird numbers along the Groot River estuary seem stable with a varied assortment. There have been 377 bird sightings recorded between January and June of 2023. This project is also an important monitoring component to assess the health of the system, and we will continue with the addition of monitoring along the Salt River (East) system.

Collectively, these monitoring efforts contribute to a comprehensive understanding of the status and dynamics of the river and estuary. By informing conservation and management practices, such monitoring programs enable timely interventions, help prevent degradation, and support the restoration of these vital aquatic ecosystems. Ultimately, the data obtained from former fish surveys, monthly co-ordinated waterbird counts, and water quality measurements play a crucial role in ensuring the long-term preservation and sustainable use of the system for both ecological integrity and the well-being of local community.

The Project Aim

To implement a water quality monitoring programme that ensures optimal and safe water quality for the area, assesses river 'health' of the system, and improves our knowledge of ecosystem functioning of a key water source area.

Objectives and Key Questions:

1. Understand how the mouth state influences selected water quality parameters, particularly during mouth opening events.
 - How does mouth state influence selected water quality parameters and bacteriological counts in the Groot River Estuary?
2. Determine how selected water quality parameters change at different water levels.
 - How does fluctuating water levels and mouth state influence selected water quality parameters?
3. Determine if there are any spatial or temporal trends in E. coli levels (particularly looking at different water levels, mouth opening events, and peak seasons).
 - What are the potential influences on fluctuating E. coli levels? And do these E. coli levels change spatially or temporally within the Groot River Estuary?
4. Determine waterbird species diversity and composition within the IBA.
 - Is waterbird composition and density impacted by water quality within the Groot River Estuary?
5. Identify sources of pollution and take any necessary remedial steps.
 - Are there sites of elevated pollution along the Groot River and Estuary? Does this show any influence on local site water quality (selected parameters and bacteriological counts)?
6. Describe any spatial and seasonal variation linking to water quality parameters, mouth state, and waterbird species diversity and composition.
 - How does water quality (selected parameters and bacteriological counts) change spatially and seasonally?

2023 Results

Water quality samples are recorded in collaboration between four local organisations including NVT, SANParks, Bitou Municipality, and the Garden Route District Municipality. Water quality data is recorded at approximately 11 sites along the Groot River Estuary between the 4 organisations. Water Samples that were taken are assessed against the limits set out in the Department of Environmental Affairs' SA Water Quality Guidelines for Coastal Marine Waters – Volume 2: Guidelines for Recreational Use, which was published in March 2012.

The test results as illustrated below in figures 3 and 4 show that the indicators for *E. coli* across five months of 2023 were well below the limits set out by the guidelines (i.e. Less than 500 counts per 100ml), with slightly elevated levels recorded at two of the sampling locations, recording above 200 counts per 100ml sampled. This is to be monitored during season as it might be necessary to take precautions until additional tests can be run. However, the indicators for *E. coli* were all within the acceptable limits set out by the guidelines across the five months and at each sampling site. The river and estuary monitoring protocols will continue as is and the frequency of tests will be increased to once per week during the peak holiday season if deemed necessary.

The risk of gastrointestinal illness indicated by the faecal coliforms levels increases if the average levels are consistently in the range of 600 - 2 000. Noticeable gastrointestinal health effects can be expected in the swimmer and bather population. Caution should be taken if higher levels as indicated become noticeable, higher levels can pose a potential health risk particularly if such events occur more frequently.

Figure 1 illustrates the correlation between salinity and temperature across the estuary at six sampling sites. Salinity ranged between 0.13 ppt in upper reaches to 32,23 ppt at the mouth, depending on mouth state and rainfall. Temperatures ranged between 11,5°C in the upper reaches to 25,4°C in the middle reaches and 24°C at the river mouth. There is variable correlation with increasing temperatures, an increase in salinity is also noticed. Figure 2 illustrates the correlation between temperature and dissolved oxygen across the estuary at six sampling sites. There is a notable correlation with increasing temperatures the amount of oxygen available in the water decreases. River mouth currently open, the number of artificial breaches is still to be supplied by SANParks to correlate between *E. coli* readings and other critical parameters.

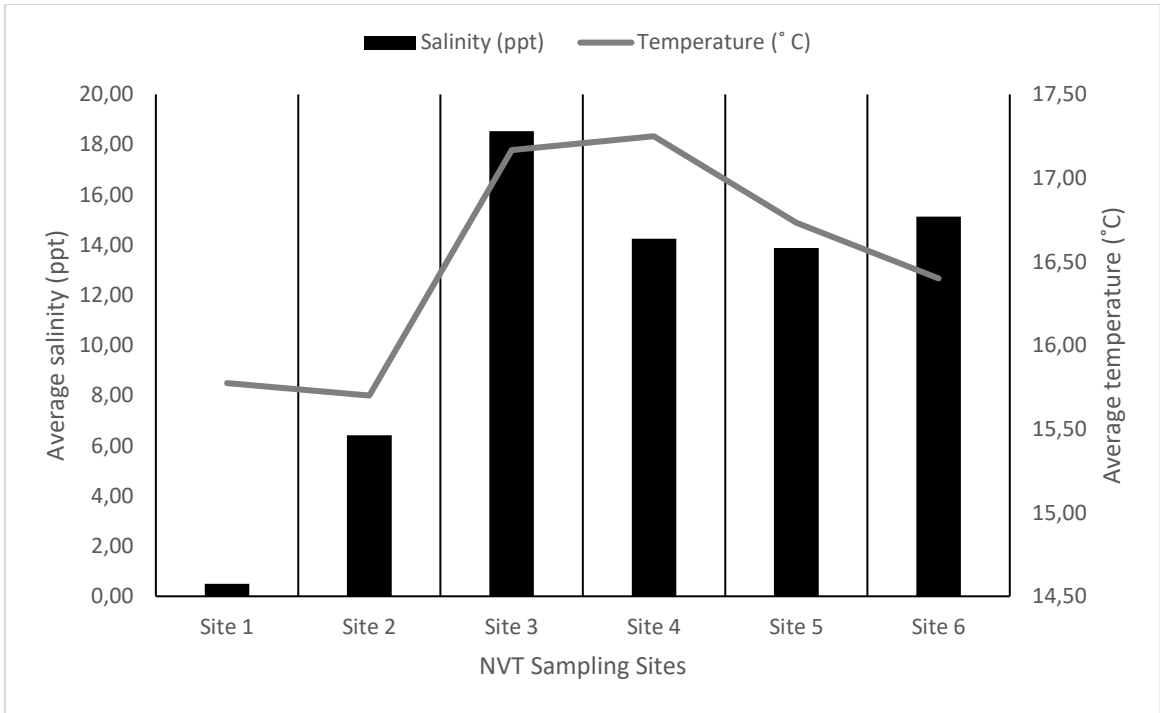


Figure 1: Correlation of the average salinity (ppt) and temperature (°C) readings across NVT's six sampling sites for 2023.

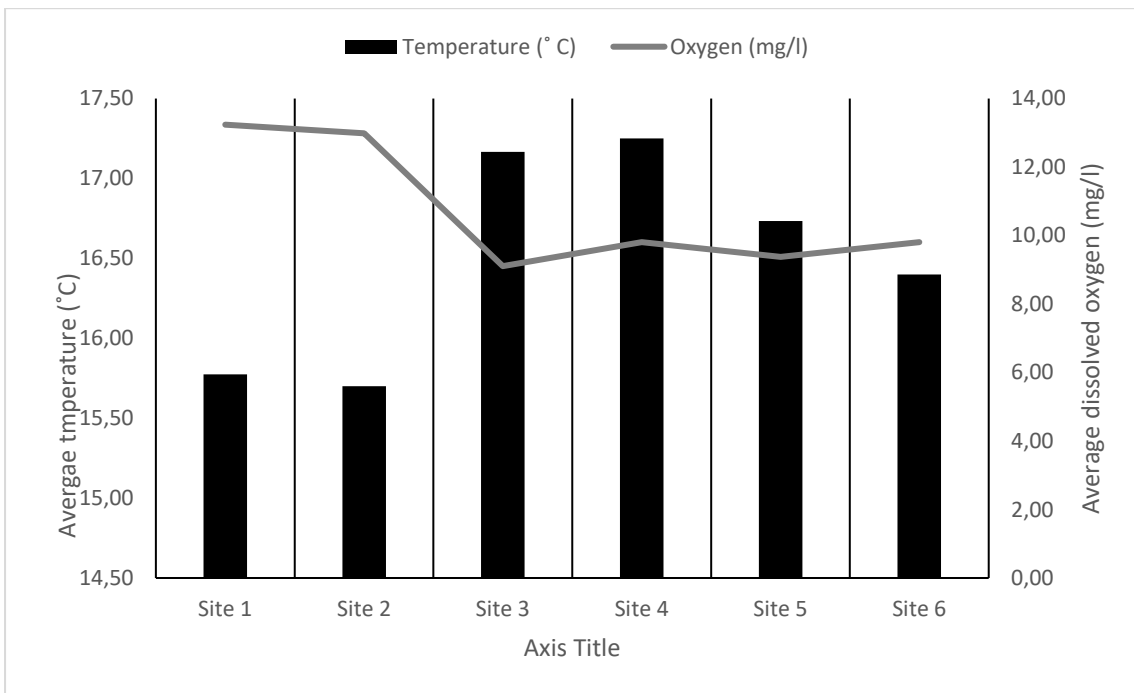


Figure 2: Correlation of the average temperature (°C) and dissolved oxygen (mg/l) readings across NVT's six sampling sites for 2023.

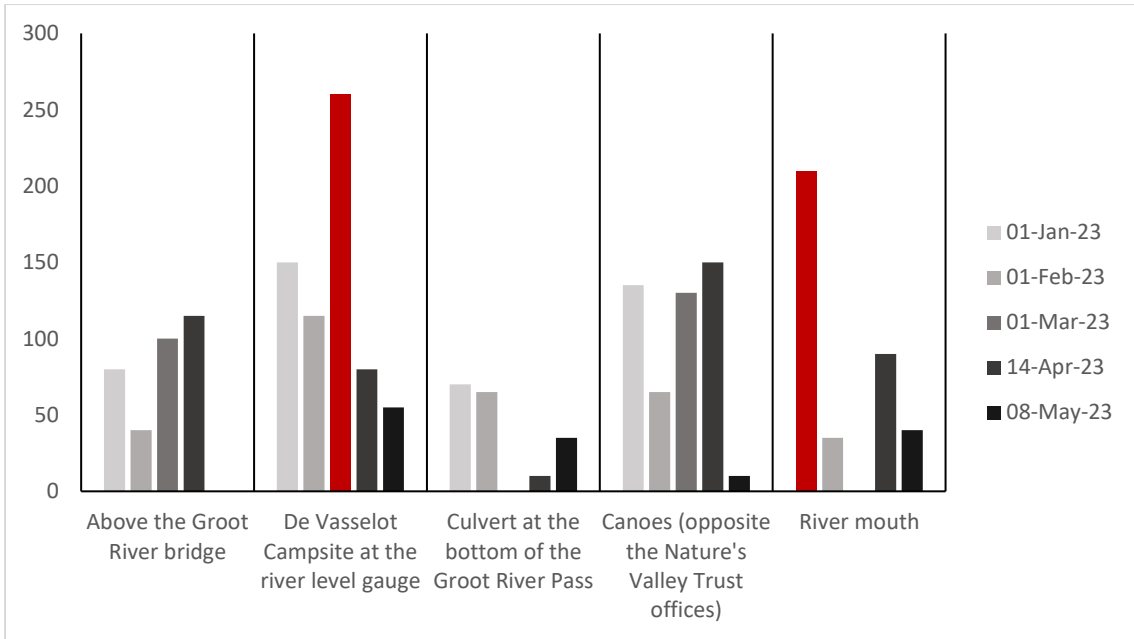


Figure 3: Bitou 2023 samples of *Escherichia coli* levels across five months in the Groot River Estuary highlighting problem areas and forecasting an increasing trend.

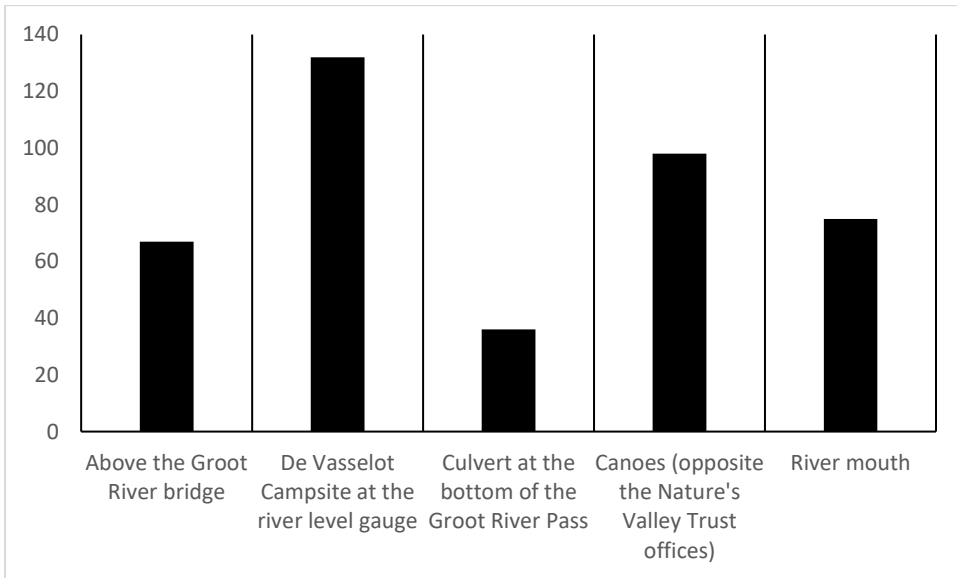


Figure 4: Bitou's sampling average of *Escherichia coli* levels in the Groot River Estuary across five months indicating no problem areas.

References

- Day, J.H. 1981. Coastal hydrodynamics, sediment transport and inlet stability. In: Day, J.H. (Ed.) Estuarine Ecology with particular reference to southern Africa. A.A. Balkema Cape Town. 7-25.
- McLachlan, A. 1991. Ecology of coastal dune fauna. *Journal of Arid Environments*, 21: 229-243.
- Morant, P.D., Bickerton, I.B. 1983. Report No. 19: Groot (Wes)(CMS 23) and Sout (CMS 22). In: Estuaries of the Cape. Part 2. Synopses of available information on individual systems. Heydorn, A.E.F. & Grindley, J.R. (eds). CSIR Research Report 418.
- Western Cape Government (2019). Groot (Wes) River Situation Assessment Report Version 4. Western Cape Department of Environmental Affairs and Development Planning.

Appendix A

Site Coordinates:

Table 1: Nature's Valley Trust sample sites coordinates

<u>Site Name</u>	<u>Coordinates</u>
A - Above R102 Bridge (GR)	-33.968364, 23.559454
B - Below R102 Bridge (GR)	-33.968316, 23.560610
C - Birding Area	-33.969838, 23.565825
D - Output area	-33.975117, 23.562109
E - Loop	-33.976890, 23.566743
F - Estuary Mouth	-33.980167, 23.569113

Table 2: Bitou sample sites coordinates

<u>Site Name</u>	<u>Coordinates</u>
Lagoon braai area	-33.980432, 23.566414
Stormwater pipe by benches	-33.978695, 23.564497
Canoes	-33.976698, 23.563497
Baboon – Outlet by road	-33.975940, 23.561633
Campsite jetty	-33.970722, 23.564170
Just Above the GR bridge	-33.968286, 23.559573

Table 3: Garden Route District Municipality sample sites coordinates

<u>Site Name</u>	<u>Coordinates</u>
Natures Valley Lagoon	-33,9765662, 23,5617192
Natures Valley Grootrivier Brug	-33,9783151, 23,5544356
Chemical sample Grootrivier pump station	-33,938522, 23,366341

Table 4: SANParks sample sites coordinates

<u>Site Name</u>	<u>Coordinates</u>
2-Estuary Mouth	33 58' 49.69"S 23 34' 09.02" E
3-First Bend in estuary	33 58' 49.31"S 23 33' 59.47" E
4-Opp. Parking Area	33 58' 49.02"S 23 33' 58.27" E
5-Yellow Bench Mark	33 58' 45.27"S 23 33' 54.18" E
6-Opp. Erf 398	33 58' 35.94"S 23 33' 48.37" E
7-Swanns jetty (de Vasselot)	33 58' 15.45"S 23 33' 51.45" E
8-Below R102 Bridge (GR)	33 58' 06.34"S 23 33' 36.72" E
9-Above R102 Bridge (GR)	33 58' 06.36"S 23 33' 31.87" E

Table 5: Groot (West) River Estuary Mapped Water Quality Sampling Sites between NVT, Bitou, SANParks, and GRDM.

