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2024

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Keynote 1

Rivers of resilience: Traversing three decades in the pursuit of pollution solutions in Africa

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The presentation chronicles Beatrice's enduring journey of confronting and mitigating the pervasive threat of pollution across ecosystems. Over three decades, this presentation traces the evolution of strategies, from initial assessments to innovative interventions, aimed at safeguarding the health and vitality of humans and ecological systems. Through a blend of scientific inquiry, community engagement, and policy advocacy, the presenter has navigated the complex currents of pollution, uncovering insights and forging pathways towards resilience. Each chapter in this odyssey unveils the challenges, triumphs celebrated, and lessons learned in discovering pollution issues and pursuing solutions. This abstract offers a glimpse into the resilience of ecosystems, echoing the enduring commitment to safeguarding these lifelines for future generations.

Keynote 2

Much of a muchness: revisiting key issues in ecotoxicology in South Africa

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In 2012 we published an opinion paper in the African Journal of Aquatic Sciences where we reflected on the status and future prognosis of ecotoxicology in South Africa and how this may address the management of these issues. In this presentation I address this marriage of ecotoxicology and environmental management through the adage of “something old, something new, something borrowed and something blue”. There are many examples of where we tend to “forget” or discount the old and regard problems as new. Case in point is the current water lettuce crisis in the Vaal River Barrage. In 2008-2009 it was mass fish kills that led to large study that concluded that failed wastewater treatment infrastructure was the main source of the multiple stressor response in the system – sound familiar? During a recent workshop on emerging contaminants, it was clear that in South Africa we are still dealing with “legacy” (the old) chemicals as these remain of concern. The lack of suitable infrastructure / capacity and environmental and an environmental management framework prohibits us from moving on to emerging contaminants (the new). All is not doo-can-gloom however, predictive ecotoxicology is starting to play a greater role in environmental management. Through the DSI the Health Safety and Environmental Risk research platform is using the mechanistic “Adverse Outcome Pathway” approach to address advanced materials hazard assessment. The current LIMCO Limpopo Basin study uses an ecosystem services approach as endpoints in the eFlows assessment, and the “new” South African water quality guidelines for aquatic ecosystems has implemented a risk-based approach.

Keynote 3

An integrated approach to the mapping, conservation and management of South Africa's freshwater ecosystems

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Scientific research is essential to inform robust decision-making and establish the context for sustainable freshwater management. The mandate of the SANBI freshwater programme is to synthesise and generate information that leads the country in freshwater management, restoration and conservation decisions. The progamme is mandated to regularly provide national status updates on freshwater ecosystems and species as part of the National Biodiversity Assessment. This paper is an opportunity to communicate the vision of this relatively new programme within SANBI. Some snapshots will be shared on work taking place within the emerging implementation framework which adopts a necessary long view to set things in place for long term success. The presentation will acknowledge existing partners, present recent spatial dataset updates, emerging data pipeline and data visualisation platforms, and discuss fragmented efforts and knowledge gaps. The national programme promotes integration across wetland, river and riparian ecosystem environments, in the pursuit of a unifying biophysical template and range of variables linking ecosystem structure and function across these ecosystems, to support a more coordinated approach to management. Finally, the work is framed within the national, and global, requirements of setting of management. The paper hopes to stimulate discussion and to invite collaboration to advance research and participation in the national framework to align efforts, including for the next National Freshwater Ecosystem Priority Areas project update.

Keynote 4

A nature-based solution for collecting and treating greywater in an unplanned settlement

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The URBWAT project initiated an iterative design process for greywater infrastructure, i.e., small-scale constructed subsurface flow wetlands (CWs), in an informal settlement in Johannesburg, South Africa, where sanitation services are currently limited. In the project, three greywater treatment CWs were built, monitored, rebuilt and maintained in collaboration with residents in the area. Multiple pressures and (competing) goals operating in a dense settlement with little space for infrastructure meant that the physical context and the use of the CWs changed rapidly. Therefore, it became clear that building structures that were more multi-functional (thinking of water collection, washing, and channelling multiple types of water) resulted in a higher use. The results from the project can inform planning processes aiming at addressing wastewater issues in urban slums with limited availability of sanitation services.

Oral presentations

1

Seasonal variations in biomarker response to microplastic presence in fish species from Lagos Lagoon, Nigeria

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Microplastic (MP) has emerged as pollutant of concern within the scientific community. Biomarkers of oxidative stress are key indicators of potential hazards by emerging contaminants. The seasonal variation in MP abundance, accumulation and biomarker responses were analysed in four commercial fish species from the Lagos Lagoon, Nigeria namely *Oreochromis niloticus*, *Chrysichthys nigrodigitatus*, *Clarias gariepinus* and *Gymnarchus niloticus* accessed during the dry and wet seasons from different sites of the Lagos lagoon. Microplastics were isolated from the gill, stomach, and liver tissues, and oxidative stress analysis was conducted by standard methods. A total of 38.2±7.1 particles/fish (max.) isolated from *O. niloticus* the in dry season while *G. niloticus* accumulated the highest in the wet season (101.8±16.0 particles/fish). Significantly ($p<0.05$) higher microplastic accumulation in the fish tissues was recorded in the wet season than in the dry season. Superoxide dismutase, and glutathione-S-transferase activities were not significantly higher ($p>0.05$) in microplastic-laden fish tissues across seasons though higher activities were noted in the wet season. The significantly ($p<0.05$) higher levels of malondialdehyde, a lipid peroxidation product, in microplastic-laden *O. niloticus* and *G. niloticus* gill suggested ongoing oxidative stress and cellular damages in the fishes. Significant levels of MDA in all the fish species in the wet season revealed more harmful impacts of microplastic accumulation in the wet season. In conclusion, the rate of accumulation of microplastics in fish tissues is season dependent and consequently resulted in more lipid peroxidation damage in the fishes during the wet season.

2

Assessing microplastics pollution in South African subterranean freshwater caves

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Microplastics measure less than 5 mm in diameter and their pollution represent a worldwide concern. Although research on microplastic pollution has been conducted in rivers, lakes and marine environments, research on subterranean environments like caves is limited. Comprehensive research is essential to comprehend the impact of microplastics on cave systems and address the potential environmental concerns. This study aims to investigate microplastic pollution in sediments, subsurface waters, and resident subterranean amphipods species across six cave systems in South Africa. The studied caves had varying human influences, ranging from largely undisturbed to those used for religious or traditional rituals, tourist attractions. Sediment, 400 L filtered subsurface waters and amphipods samples were collected. Microplastics from the sediments were extracted using density separation method (NaCl). During extraction process, microplastics were detected in all sediment and water samples collected across six caves. The microplastic concentration in both sediment and water samples correlated with human usage of the cave, with caves that were used for religious rituals had the highest and those with limited human usage the least. Some of the caves had microplastic concentration that was comparable to the most polluted rivers demonstrating the extent of microplastic pollution in (sub)surface waters. The presence of microplastics in sediments and subsurface waters presents a threat to cave aquatic biota, as amphipods also ingested them thus affecting their developmental status with a high possibility to be further move up the trophic levels.

3

Identifying environmental factors influencing the concentration, fluxes and spatial distribution of microplastic pollution in an urban river: A case study of the Klip River, South Africa

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There is scarcity in research addressing the sources, behaviour and transportation pathways of microplastic pollution in urban freshwater systems in developing countries. We investigated the relationships between catchment characteristics and concentration, spatial distribution and monthly fluxes of microplastic particles in six locations along the Klip River from November 2020 – October 2021. Microplastic particles dominated by fibres were observed in all sampling sites with monthly concentrations ranging from 0.18 to 2.90 particles L^{-1}. Land cover has a significant impact on microplastic concentrations in the catchment, particularly when comparing formal and informal residential areas. Annual fluxes estimated from modelled runoff ranged from 9.69×10^8 MP/year to 4.41×10^{10} MP/year. However, measured flow data from the downstream site indicate that actual flows, including return flows from densely populated urban water systems, are almost ten times greater than modelled runoff. Hence the calculated flux at site 6 is 4.34×10^{11} MP/year. Rainfall is an important predictor of monthly MP inputs to the Klip River, explaining two thirds of variance in concentrations (adjusted r^2=0.661, p<0.001) and 58% of variance in fluxes at site 6 (r^2=0.584, p=0.002). The influence of wetlands in retaining microplastic particles is unclear in the present study: despite the presence of riparian wetlands in all subcatchments, fluxes increased downstream through most of the wetlands except between site 4 and site 5. Further research is needed to understand the importance of landcover drivers, wetland types, surface runoff and wastewater return flows in determining microplastic transport through river catchments.

4

Abundance and characteristics of microplastics at Zandvlei Estuary, Cape Town, South Africa

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The increasing prevalence of microplastics in coastal environments is cause for concern, but knowledge of its distribution in estuaries is poor in southern Africa. This study aimed to measure the abundance and characteristics of microplastics in the Zandvlei Estuary, Cape Town, South Africa. Surface water, estuarine sediment and reed sediment were analysed for microplastics at five different sites along the Zandvlei Estuary during winter (wet season) of 2022. Microplastics were mainly fibres, black/grey, 1000 to 2000 µm in size and the main polymer types were Polyethylene (43.5%) and Polypropylene (41.1%). A total of 3282 microplastics were recorded with an average of 117 (± 21.2 SEM) particles/unit. Microplastic concentrations were higher in the surface water samples (341 ± 39.81 particles/L) and significantly different to estuarine sediment (9.76 ± 3.65 particles/kg) and reed sediment samples (32.51 ± 15.46 particles/L and 8.08 ± 6.59 particles/kg). The results suggest that the high concentration of secondary microplastics (fibres) is a significant source of microplastic contamination and can aggregate in reed sediment. Thus, the research indicates the need for future investigations and monitoring of microplastics at the Zandvlei Estuary.

5

Trophic transfer of microplastics between benthic primary consumers and predaceous dragonfly larvae in two South African streams.

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Catalysed by mounting environmental concerns and the potential ecological ramifications of microplastic pollution, this study explores the widespread existence and potential ecological consequences of microplastics in freshwater aquatic environments. The study investigates the pathways of microplastic contamination through sediment, water, and the trophic transfer of microplastics between benthic primary consumers and predaceous dragonfly larvae in two South African streams. In the pursuit of accurate and efficient detection methods for microplastics in the environment, alongside the standardization of analytical techniques within the South African context, this study investigates pioneering methodologies aimed at refining our comprehension of microplastic pollution within South African freshwater ecosystems. Specifically, the application of Raman spectroscopy for polymer identification and the integration of novel, cost-effective laboratory techniques are explored as means to advance our understanding of microplastic distribution within freshwater environments. Microplastics were identified across all sites in water, sediment, and dragonfly larvae samples. This study demonstrates the ubiquitous nature of microplastics within freshwater environments and their potential to traverse trophic levels, which may have detrimental effects on aquatic health in these streams.

6

Assessing microplastic abundances in freshwater fishes in a subtropical African reservoir

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Microplastics are emerging pollutants of global concern, and their presence in the aquatic environment poses a serious risk for aquatic biota. This study investigated microplastic abundances and distribution in freshwater fishes within Nandoni reservoir, South Africa across two contrasting seasons (i.e., hot–wet, cool–dry). Fish were sampled using seine and gill nets, before being ethically euthanised using an overdose of 40 mg L−1 of clove oil added in a holding bucket, and later preserved in ethanol. In the laboratory, fish were then separated according to their taxa prior dissecting to remove the gills and gastrointestinal tract (GIT). The organs were digested using the hot hydrochloric acid and hydrogen peroxide, and the microplastics were classified according to their colours and shapes. Among the 94 fishes (i.e, 8 species) examined, microplastics were detected in 86.6 % of the eight species caught. Microplastics were dominant during the cool–dry season in the gills, and hot–wet season in the GIT. High microplastic abundances were found in the gills of *Micropterus salmoides* and the GIT of *Coptodon rendalli* where fibre type and transparent colour were the most dominant, respectively. The results further showed high microplastic abundances in benthopelagic feeders indicating that habitat influences fish consumption of microplastics. Microplastic abundances in the reservoirs could be due to anthropogenic activities such as illegal dumping, fishing, and agriculture. There is a need for further investigation in relation to fish weigh, fish sex and body.

7

Contextualizing microplastic pollution in different river habitats through rapid habitat analysis

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Microplastic research in rivers has rapidly increased over the last decade. However, no clear or concise method exists for the sampling of microplastics in rivers, with researchers making use of plankton nets that have the ability to contaminate the sample or through various volumes of bulk water collected and filtered, with various replicates used. This leads to studies where a single river system could have various levels of microplastics that can significantly change between sites. These changes have been related to the surrounding anthropogenic activities; however, the context of the environment may contribute to the concentrations found. The aim of this study was to determine microplastic abundances in water and sediment, with a critical evaluation of the site where sampling took place to determine which environmental factors would impact microplastic distribution. The results indicated that the use of a bulk water sample did not have significant differences in microplastic concentrations, however, the study determined that environmental factors such as velocity, river obstructions, and most importantly, discharge, can change the context of the microplastics at the site, and how it may impact niche specific organisms. The results of the study were used to produce a new measurement to provide a contextualised representation of microplastics at a site that could be used as a better indicator of microplastic pollution at the site and its impact on biota.

8

Evaluating diatoms, macroinvertebrates, and water quality following a severe pollution event in the uMsunduzi River, KwaZulu-Natal

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Monitoring abiotic and biotic conditions to assess water quality provides a holistic approach to managing freshwater ecosystems. Following a mixed product chemical spill from the Willowton Group Ltd facility in August 2019, negatively impacting the uMsunduzi River, Pietermaritzburg, KwaZulu-Natal, South Africa. We assessed the post recovery of water quality using physico-chemical parameters and water chemistry and biotic indices quarterly to assess the water quality, including benthic diatoms and aquatic macroinvertebrates, using the South African Scoring System version 5 (SASS5). We found that water quality had improved, given the remedial assimilation of pollutants and dilution as they moved downstream, such that further downstream sites had improved significantly. The pollution-sensitive taxa (diatoms and macroinvertebrates) were starting to colonise the downstream sites, Grimthorpe (FR2) and Inkanyezini (FR3), depicting recovery in water quality. However, toxic industrial and sewage inputs compromised water quality recovery in sites near the city. It is recommended that the existing legislative framework be properly enforced to curb the input of toxic effluents from industrial operations, sewage networks be properly maintained, and conservancies be established to protect water resources. Furthermore, continual monitoring is recommended to ascertain pollution sources and manage to mitigate their impacts on water quality in the uMsunduzi River.

9

Nutrient enrichment effects in Richards Bay Estuary in the context of the Pearson and Rosenberg Paradigm

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The Pearson and Rosenberg (P-R) paradigm represents the succession of macrobenthic fauna in a temperate estuary subjected to organically enriched sediments. Changes to the model in relation to fin-fish aquaculture and its effect on the macrobenthic community were assessed in Richards Bay Estuary (RBE). The model classifies macrofaunal changes along a decreasing gradient of organic pollution into five categories: zone 1 - an azoic area, at or adjacent to the discharge point; zone 2 - a poor community dominated by an abundance of a few opportunistic species; zone 3 - an ecotone point characterised by low abundance and high diversity; zone 4 - a transitional community with the highest number of species and zone 5 - a community with a stable species number and abundance. The results showed that only a few opportunistic macrobenthos were observed near the fish farm (sites 1 and 2), resulting in the zone 2 classification. While, the number of species increased away from the fish farm, with a drastic increase observed after the ecotone point (site 3). Following the ecotone point, the macrobenthic community abundance gradually declined to stable conditions, represented by sites 4-5 and the reference site. The RBE macrobenthos adhered to the paradigm, and AMBI validated the model's conclusions while demonstrating the absence of azoic conditions, confirming the standing consensus that a gradient of diminishing impact generally extends outwards from an estuarine fish farm and that the nature of the impact, in RBE, was limited in extent but severely impacted the macrobenthic community.

10

Water quality monitoring informing management decisions in the Mzimvubu Estuary, South Africa

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The Department of Water and Sanitation, Resource Quality Information Services Directorate developed and implemented the National Estuarine Monitoring Programme (NEsMP), as mandated by the National Water Act. The NEsMP is currently concentrating on water quality monitoring in estuarine systems. The primary goal of this experiment was to demonstrate how water quality might influence management decisions. The Mzimvubu Estuary was chosen as case study for this project. An *InSitu* Handheld meter was used to gather system variables at six sites in the Mzimvubu Estuary. Between January 2017 and July 2023, the physicochemical variables were monitored at 0.5m depth intervals every month. Water quality samples for nutrient and chlorophyl a analyses were obtained at 0.5m depth at various sites in the estuary. Accredited procedures were used to determine total ammonia, nitrate, nitrite, and reactive phosphate. Chlorophyll *a* was used as surrogate for phytoplankton biomass. Salinity trends were observed in connection to daily tidal flow. Temperatures followed seasonal trends, and the estuary has high oxygen levels, above 5 mg/L. No notable correlation between salinity and nutrient concentrations, nor between chlorophyll a and nutrients. DIN and DIP surpassed the Threshold of Potential Concern when compared to the Resource Quality Objectives established for the estuary in 2018. The Mzimvubu Estuary is still in good condition. Continuous water quality monitoring is critical for recognizing possible system changes in response to pressure and water quality deterioration. Monitoring of Mzimvubu Estuary is envisioned to expand to tier 2 monitoring to allow for the incorporation of biological data.

11

The utility of environmental monitoring in understanding the recovery of estuarine habitats subject to chronic and acute stressors along South Africa's east coast

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Systematic environmental monitoring is critical for proactive management and prioritised decision-making for habitat restoration. In this South African case study, we show that this is especially relevant to estuaries which are often on the receiving end of chronic and acute stressors associated with their feeder rivers. The Ohlanga River and its associated uMhlanga Estuary in South Africa have been subjected to long term chronic anthropogenic stressors and an acute catastrophic agrochemical spill in July 2021. The spill event resulted in large fish die-off and severely altered the riparian and aquatic ecosystem, which necessitated remediation and rehabilitation of the Ohlanga River and its estuary. Two years on from the spill, we assessed the system's recovery using water quality parameters and three important biological indices: fish rapid assessment index (FRAI); South African scoring system version 5 (SASS5); and benthic diatoms. For comparative purposes, and to specifically assess the value of the indices for decision-making, two other estuaries and their associated feeder systems, namely; the uMdloti and iMpenjati rivers and their associated estuaries, were assessed using the same indices. Our findings show that the three estuarine ecosystems are exposed to varying degrees of anthropogenic stress and the indices selected reflect this. Furthermore, the study highlights the value of selecting and integrating relevant biological indices into environmental monitoring exercises aimed at tracking the recovery of estuarine systems from multiple stressors, including imposed by climate change. However, certain indices are specific to rivers and estuaries which compromises their complementarity when assessing the river-estuarine continuum.

12

Microbial assessment of the anthropogenically impacted Sundays and Swartkops estuarine systems

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Anthropogenic activities severely impact estuarine systems, particularly in the South African context where reduced freshwater input and poor waste water treatment are common. Eutrophication, algal blooms, xenobiotics, occurrence of human bacterial pathogens and shifts in bacterial biodiversity patterns are known indicators of poor water health and ecosystem degradation. This study focused on two geographically linked estuarine systems, namely the Swartkops and Sundays estuaries and investigated the nutrient profiles, bacterial diversity and relative abundances, as well as the presence of xenobiotics in the dissolved organic matter (DOM). The Swartkops Estuary is heavily impacted by urban and industrial activities. This impact is reflected in the increased levels of phosphates, occurrence of several potential human bacterial pathogens (e.g. *Vibrio cholera*), high levels of bacterial species typically indicative of raw sewage contamination, as well as the presence of xenobiotics such as pharmaceuticals and antiretrovirals in the water column. In contrast, the Sundays estuary is primarily impacted by agricultural activities in the catchment area with increased nutrient input from fertilizers. Bacterial community profiles indicative of algal bloom association and DOM molecules annotated as agrochemicals which far exceed the no-effect concentrations were observed in the Sundays River system.

13

Exploring pesticide presence: The Evil-eye Blaasop's journey along South Africa's coastline

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The coastal regions of South Africa are under pressure due to the introduction of pollutants into these systems through various sources, including industrial and agricultural runoff, sewage discharge, contaminated stormwater drainage, and effluents from informal settlements. This results in increased concentrations of persistent organic pollutants (POPs). The study focused on assessing two global priority contaminants, polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs), in muscle and liver tissue of the Evil-eye blaasop, *Amblyrhynchotes honckenii* (Bloch), along the South African coast. Six sites inside, near and outside marine protected areas (MPA) were assessed: Witsand (WS), Mossel Bay (MB), St. Francis Bay (FB), Chintsa East (CE), Uvongo (UV), and Sodwanna Bay (SB). Liver samples from non-MPA sites (MB, FB and UV) exhibited higher levels of POPs compared to MPA (CE, SB) or near-MPA sites (WS). Nine OCPs were detected in fish at each of the sites, notably oxy-chlordane, particularly prevalent in WS, MB and CE. Regarding PCBs, 16 congeners were detected in fish, with SB being the only site where no PCBs were detected in muscle and liver samples. Notably, hexachlorobiphenyl PCB153) was detected in fish from all other sites, with the highest levels of all 16 congeners in fish from FB. This study highlighted the persistent nature of PCBs and OCPs in South African coastal ecosystems. The differences in contamination levels at the sites underscore the need for targeted environmental management strategies to mitigate the impact of industrial, agricultural, and urban activities and safeguard the long-term sustainability of these vital coastal ecosystems.

14

Understanding stakeholders' perceptions of co-management on small-scale fisheries in the Wild Coast of South Africa through evaluation research

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Over-exploitation of fisheries resources is a problem threatening the sustainability of small-scale fisheries (SSF) in the worldwide due to government top-down management approach. The management of SSF is now shifting towards participatory management approach such as co-management. Co-management of SSF is complex and has yielded different outcomes in different countries due to different socio-economic, socio-political and socio-cultural conditions. This study therefore evaluated stakeholders' perceptions of co-management to determine its suitability for the management of SSF in the Wild Coast of South Africa. Eleven participants from government, academia, non-profit organisations and fishers from four sites were sampled. Semi-structured interviews were conducted using questions formulated from the themes derived from the literature. Interview data were analysed using thematic analysis. All respondents understood co-management as partnership involving stakeholders for the management of fisheries resources. However, different perceptions were noted on the benefits of co-management, which could suggest different interests in co-management for the respondents. Different perceptions were also noted on the involvement of government as a key stakeholder and adequacy of the government's interventions to involve communities in decision-making. The respondents associated co-management with more benefits than cost, suggesting that co-management of SSF was a possible management approach for the Wild Coast. Creating a shared understanding of co-management as a collaboration point for different stakeholders and using the overlaps of stakeholders' perceptions were considered necessary to start co-management to enhance the sustainability of SSF in the Wild Coast.

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An evaluation of present and potential inland fisheries in dams and rivers in the uThukela and uMngeni Catchments, KwaZulu-Natal, South Africa, based on fishers' perceptions

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The governance of inland fisheries in South Africa is shaped by a complex interplay of stakeholders, largely vested in the resources found within public dams. Various fishing sectors, including small-scale, commercial, subsistence, and recreational fishers, constitute this stakeholder group. Among them, recreational fishers play a prominent role because of their direct economic contributions. These sectors are crucial for local sustenance and livelihoods. However, ambiguity surrounding the recognition of subsistence fishing rights in relation to recreational and small-scale fishing has led to conflicts. This study addresses the lack of understanding regarding economically valuable fish species and their exploitation, focusing on perceptions of fishers in specific sections of the uMngeni and uThukela catchments in KwaZulu-Natal, South Africa. Using questionnaire interviews conducted between 2021 and 2023, the study reveals challenges in classifying fishers, reflecting the global complexity of inland fisheries governance. Fishers' insights highlight ecological imbalances between native and invasive species, with economic considerations emphasising the market value of certain species, notably *Cyprinus carpio*. Subsistence fishers predominantly engage in river fishing, contrasting with recreational fishers targeting impoundments. A significant portion of subsistence fishers consume fish infrequently but rather sell it. The study underscores the need for comprehensive management strategies encompassing water regulations, fish ecology, and economics to ensure the sustainability of inland fisheries.

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Qualitative and quantitative assessment of the Ikgomotseng small-scale fisheries pilot research project at Krugersdrift Dam, Free State Province

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The National Freshwater (Inland) Wild Capture Fisheries Policy, approved by the South African Cabinet during August 2021, and subsequent Implementation Plan (December 2022), called for the establishment of small-scale fisheries pilot research projects due to paucity on information for this sector. A project, involving nine youth from Ikgomotseng, was implemented during 2022/2023 at Krugersdrift Dam. Three long lines with sixty #6 circular hooks, a beach seine net and three double-ended Dutch type fyke nets were used to harvest fish. Fyke nets and long lines were set for four netting nights, while the beach seine net was used daily. The long lines selected exclusively for sharptooth catfish *Clarias gariepinus.* Catches from the beach seine net were dominated by common carp *Cyprinus carpio* (75%), followed by moggel *Labeo umbratus* (13%) and *C. gariepinus* (10%). Catch rates from fyke nets were very low. Based on the total weight of the total catch sold at an arbitrary price of R15,00/kg, the monetary value of the total catch for the 12-month period was R102 029,61. Fishers' income varied from R17 045 to R20 862 during the study period. Based on an assessment of the fish-selling price, *C. carpio* was sold at R28/kg, *L. umbratus* at R24/kg, and *C. gariepinus* at R17/kg. Fishers also donated and bartered some of their catch, while some fish were kept for own use. This paper will present the results of the pilot research project, with notes on the biological sustainability and economic viability of the fisheries.

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The migration of aquatic macrocrustaceans over an artificial barrier in the uThukela River, South Africa

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Diadromous macrocrustaceans need connectivity between the ocean, estuary and river to complete their life cycle. Instream barriers in lower reaches of rivers threaten upstream migrations of diadromous macrocrustaceans. *Varuna litterata* migrate upstream after a spawning event out at sea. These migration events have been poorly documented. We documented the presence *V. litterata* and *Macrobranchium* spp. at a vertical slot fishway and a rock ramp on the Lower Thukela River Bulk Water Supply Scheme Weir, KwaZulu-Natal, South Africa, during 2021- 2022. We found *Macrobrachium* spp. and *V. litterata* made use of the rock ramp. However, the vertical slot fishway did hinder the migration of *V. litterata* significantly, as found in other studies.

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Comparative assessment of phytoplankton and macroinvertebrates from freshwater and saline lakes in South Africa

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Freshwater and saline lakes generally exhibit different patterns in nature, with the former supporting diverse macrophytes while the latter is usually devoid of macrophytes but support high volumes of waterbirds potentially gorging on zooplankton or phytoplankton. However, these patterns have generally not been adequately studied in South African lakes. As such, our study investigated the diversity and community composition of phytoplankton and macroinvertebrates from three different lake types in South Africa (coastal freshwater lakes, freshwater inland lakes, and saline inland lakes). In this presentation, we will (1) demonstrate the biodiversity patterns of the studied taxa from the three different types of South African lakes and, (2) investigate important environmental drivers responsible for their community composition. It was hypothesized that there will be differences in the water quality, biodiversity and community composition between the lake types and also that this variation will have a strong temporal variation ("winter" vs "summer") with the effects more pronounced in winter. Specifically, we expected saline inland lakes to support highest phytoplankton diversity and abundance, while freshwater inland lakes, with complex vegetation structure, to support highest diversity of macroinvertebrates, and vice-versa. With both the studied taxa and water quality, we expected coastal freshwater lakes, which were much bigger and deeper than these two other lake types to have intermediate diversity patterns. Our results generally supported our hypotheses, with only a few exceptions. We were surprised by the lack of zooplankton, especially in the saline lakes, which we expected to be the cause for waterbird aggregation.

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Riparian vegetation as indicators of flow duration and frequency

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The increasing number of dams and weirs result in the alteration of natural flows. Limited knowledge exists on the topic of inundation tolerances and thresholds of the biological communities within freshwater systems; therefore, we do not know the consequences of the frequency and durations of artificial flooding events following water release by dams and weirs. This study aimed to use plants as biological indicators under controlled experimental conditions. This was done by inundating four riparian and one terrestrial plant species and measuring the stress-related responses. When a plant experiences stress, their ability to create, transfer and utilise energy is compromised. The degree of compromise is measured in the antennae fluorescence (Chlorophyll *a*) within the surface of the leaf using a modulated light source. Three measurements of stress were recorded: PI total (photosynthetic performance index), maximum quantum yield efficiency (Fv/Fm) and the transport of electrons from PSII to PSI (OJIP). Water quality variables were also recorded. The responses of the plant species varied both physically and physiologically with some species showing lower inundation tolerances, however recovery rates for these species were accelerated. Physical adaptions included increased root growth for woody plants and increased spreading of the non-woody species. Overall impressions show that inundation tolerances were higher than expected and recovery rates were rapid. The findings from this study could assist us in understanding the flow requirements of riparian vegetation thereby improving the overall condition of riverine ecosystems.

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The role of anthropogenic barriers in restricting connectivity in aquatic environments in the lower uMkomaas River, South Africa

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The construction of instream barriers, such as dams and weirs, impairs river connectivity. In most cases, instream barriers obstruct connectivity in aquatic systems and hinder the movement of fauna, especially species that have migratory requirements. Fishways are not always built into these structures or are often poorly built, leading to the loss of connectivity for migratory species. The loss of connectivity within these ecosystems can have dire consequences, especially for catadromous fish species such as Anguillid eels. These species migrate long distances from the ocean into estuaries and then into freshwater systems, where they live and grow before they return to spawn at their natal locality in the ocean. Therefore, Anguillid eels are good indicators of ecosystem connectivity. In the lower uMkomaas River, KwaZulu-Natal, South Africa, selected instream barriers (n = 4, with two more being constructed) were built for various purposes, and either have no fishway or fishways retrofitted, potentially disrupting fish connectivity. This study aims to evaluate the effect of these instream barriers on fish community structures and assess the abundance of Anguillid eels. Biannual sampling for fish using electro-shocking techniques at localities between the barriers was undertaken from March/April and July/August 2024. Our findings are preliminary following the present sampling. We predict that instream barriers will negatively impact the abundance of fish communities and eels caught. The outcomes of this study will provide us with valuable information that could be used to improve and maintain connectivity in freshwater ecosystems and protect migratory aquatic species such as the Anguillid eels.

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Re-evaluation of the river eco-status programme of KwaZulu-Natal rivers after 10 years

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Rivers are increasingly threatened by human activities, emphasising the urgent need for sustainable management and monitoring of these vital ecosystems. In KwaZulu-Natal (KZN), South Africa, the River Eco-status Programme (REMP) has been instrumental in monitoring and assessing the ecological health of rivers in the region. As part of this program, Evans *et al.* (2022) conducted a study that examined fish community structures across the KZN during a severe drought. The study highlighted various challenges, such as limited species distribution knowledge and the impact of non-native invasive fish species, particularly bass (Micropterus spp.), on native fish populations. One key recommendation from the study was to re-evaluate fish communities in KZN rivers after several years of anticipated above-average rainfall to assess the recovery of fish species and targeted species not captured in the Evans *et al.* (2022) study. In response to this recommendation, REMP is undergoing a comprehensive re-evaluation after 10 years to bridge the gaps identified in the previous study, assess changes in fish communities and river health, and recommend strategies for enhancing conservation and management efforts. Fish community assessments will be conducted at relevant sites using methods described in Evans et al. (2022), with additional sites selected to assess specific stressors and long-term changes. In addition to fish collections, in situ water quality will be assessed, and the Fish Rapid Assessment Index (FRAI) will be conducted to associate fish community assessments with management objectives. The findings of this re-evaluation are expected to provide valuable insights into long-term changes in the ecological integrity of KZN rivers contributing to the conservation and sustainable management of rivers and freshwater ecosystems. This is important, particularly in the face of ongoing environmental challenges such as climate change and river degradation

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Water beetles as indicators of climate change vulnerability in South African freshwater ecosystems

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The rapidly changing climate is a global phenomenon that is expected to have severe impacts on our water resources in South Africa. However, specifics regarding the nature and extent of these effects on aquatic ecosystems have not been adequately investigated. This is mainly due to the lack of empirical studies testing biotic responses to the expected thermal changes resulting from climate change. Macroinvertebrates are one of the best-known indicators of environmental change in freshwater ecosystems, and within this group, water beetles show promise as indicators of thermal stress. There are a limited number of studies that focus on investigating the thermal tolerance of water beetles in Austral regions when compared with those available for the Northern Hemisphere. This study aims to compare the vulnerability of widespread Pan Ethiopian vs ancient Gondwanan fauna to climate change by assessing the relative thermal sensitivity of water beetle taxa inhabiting each faunal group. It also aims to compare this data with the available data from the Northern Hemisphere. The study utilizes both dynamic ('Critical Thermal Maximum/Minimum' – CTM) and static ('Incipient Lethal Temperature' – ILT) exposures to assess relative differences in thermal tolerance among the regions, habitats and taxa. It is broadly hypothesized that Pan Ethiopian water beetles will be more vulnerable to climate change than Gondwanan water beetles.

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Assessing fish and macroinvertebrates assemblages in relation to environmental variables in Makuleke floodplain pans: Implications for biodiversity conservation

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Floodplain wetlands remain important habitats for most macrophytes, macroinvertebrates, birds, fish, amphibians, wildlife and in particular large mammals. They are dynamic in nature and provide many ecosystem services even to humans. The present study aims to assess water and sediment chemistry as drivers of macroinvertebrates and fish communities in Makuleke floodplain wetlands in north Kruger National Park, South Africa. Water, sediments, macroinvertebrates and fish samples were collected across different hydroperiods (i.e., Low water period and high water period) from six floodplain pans. Macroinvertebrates were dominated by (Notonectidae, Libellulidae, Gerridae, Chironomidae larvae, Belostomatidae, gomphidae, dytiscidae and Baetidae, while fish were dominated by *Tilapia sparminii*, *Gambusia affinis*, *Coptodon rendali*, *Oreochromis* hybrid, *Oreochromis mossambicus*, *Enteromius palludinosus* and *Clarias gariepinus*. Generally, fish and macroinvertebrate abundances and diversity were elevated during high water levels as compared to low water levels, suggesting that hydroperiod plays a significant role in structuring aquatic faunal communities. Redundancy and canonical– correlation analysis identified salinity, TDS (water) and Zn, C and B concentrations (sediment) as the major drivers of macroinvertebrate community structure, while pH, TDS (water), and K, Ca and Mg concentrations (sediment) were the major drivers of fish communities. In addition, pelagic chlorophyll –a was strongly positively associated with fish, particularly *Gambusia affinis*, during the high water level period. The results of this study provide important baseline information on the ecology of the Makuleke pans.

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Unveiling the identity of South African mollusc species from the family Sphaeriidae

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Sphaeriidae bivalves are small freshwater molluscs that contribute to nutrient cycling in the water column, play a role in oxygenating the water and sediment, and form a transitional link between producers and consumers. However, their importance is not shown in the research effort of the past few years and, when considering previous literature, it is evident that the densities in which these bivalves are found have decreased immensely. Sphaeriids have a worldwide distribution, but the knowledge of South African sphaeriid species is lacking. These knowledge gaps include their current distribution, abundance, and the diversity of species still present. Sampling for the bivalves were completed from 2022 to 2024 in the eastern provinces of South Africa i.e. Limpopo, Gauteng, Mpumalanga, and KwaZulu-Natal. Three different genes were amplified using PCR, namely, COI, 16S, 28S whereafter we were able to generate 108 sequences from 11 different sites. A phylogenetic tree was constructed using existing sequences from GenBank and BOLD where the organisms formed four separate clades. This preliminary work suggests three different genera are present, however, this differs from the morphological identities based on photomicrographs and the currently available keys. This project aims to summarise the available information on the South African Sphaeriidae bivalves, provide detailed morphological notes on species collected, as well as generate the first molecular sequences of these sphaeriid species worldwide. The results will aid future research and molecular phylogenetic studies on these noteworthy but neglected molluscs.

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Chasing marine fish parasites: A South African story

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The history of marine fish parasitological study in South Africa dates back to 1818 when Leach described the cymothoid isopod *Anilocra capensis* from a hottentot seabream, *Pachymetopon blochii*, caught off the coast of Cape Town. Research on marine parasites was subsequently performed by various authors, with key work by the likes of Stebbing (1900s), Fantham (1910s–1930s), Barnard (1920s) and Kensley (1940s–1960s) incrementally advancing knowledge regarding the richness present in South African waters. It is important to note, however, that although such advancement appears coherent through time, the work on any one parasite group is actually punctuated by long periods of inertia. As a consequence, South Africa lags behind many regions of the world in terms of the number of parasite species known and reported. Almost ten years ago, Smit and Hadfield (2015) provided a comprehensive review of the state of marine parasitology in South Africa. In that paper, recommendations for the future direction of research included focussing on the lesser studied groups, such as monogeneans, protists and Myxozoa, and broadening the scope of research on marine fish parasitology to include ecological and applied aspects, using modern techniques. The aim of this presentation is thus to revisit these recommendations of ten years ago and provide some insights into the growth in our knowledge and understanding of marine parasitology in South Africa since 2015 with specific emphasis on the work done by the NWU Water Research group and their extensive network of collaborators.

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Offshore intermediate hosts for inshore digeneans? A new hypothesis for digenean life-cycles

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Both benthic and pelagic marine cnidarian and molluscan invertebrates serve as intermediate hosts for a wide range of fish-infecting trematodes (Platyhelminthes: Digenea). The role of those pelagic cnidarian and molluscan species forming the pleustonic (i.e., surface-floating) fauna as intermediate hosts for marine digeneans, however, has been little-investigated. My talk will present the results of a study undertaken on North Stradbroke Island, Queensland, Australia. Regular surveys of beach-stranded pleuston were conducted between 2018 and 2020 during seasonal episodes of easterly winds. During these surveys, unencysted metacercariae of the superfamily Lepocreadioidea (Digenea) were recovered from molluscs *Glaucilla* cf. *marginata* (Glaucidae), *Glaucus atlanticus* Forster (Glaucidae) and *Janthina janthina* (L.) (Epitoniidae), and from the cnidarian *Porpita porpita* (L.) (Cnidaria: Porpitidae). Morphological and molecular analyses identified these metacercariae as a species of *Clavogalea* Bray, 1985 (Lepocreadiidae), a genus infecting pompanos, i.e. strictly coastal fishes of the genus *Trachinotus* Lacepède (Carangidae). While these infections could be dead-ends, we hypothesise that molluscan and cnidarian pleustonic organisms are viable seasonal opportunistic intermediate hosts for *Clavogalea* sp. This study highlights the need to consider the strong connectivity between inshore and offshore marine environments for elucidating digenean life-cycles.

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Hidden biodiversity of ephemeral ecosystems: *Nothobranchius* spp. as hosts of helminth parasites

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Nothobranchius killifish are known from temporary pools in southern Mozambique and have unique life history adaptations to survive the radical wet and dry phases that characterise these pools. Their rapid life cycle implies that the timing of their interactions with potential parasite vectors are affected. The present study aimed to determine the parasitic communities of *Nothobranchius furzeri* and *Nothobranchius orthonotus* collected from temporary pools in Karingani Game Reserve in southern Mozambique. Pools were sampled using sweep nets. In total 33 *N. furzeri* and 24 *N. orthonotus* were sampled. Each host individual was screened for endo- and ectoparasitic infection. The overall parasite prevalence for *N. furzeri* across the five pans were 60 – 100%. Three individual hosts from two pans had free metacercaria in the cranial cavity [intensity of infection (IF) 3 – 14], one pan's individual had a metacestode from the intestine. All five pools had hosts that were parasitised with encysted metacercaria in various tissues (IF 1 – 177), while only four pools had fish with intestinal nematodes (IF 1 – 12). The overall parasite prevalence for *N. orthonotus* was 100% from each pan and the parasitic communities across the three pools consisted of nematodes from the intestine (IF 1 – 22), encysted digenean metacercaria (IF 1 – 192) and one free metacercaria present in the cranial cavity of a single fish from one pan. These results provide insight into the diversity and distribution of parasites in the *Nothobranchius* populations of the temporary pools during a dry/wet season. Thus, understanding the presence of *Nothobranchius* spp. and their parasitic prevalence highlights the importance of the monitoring and management of these aquatic ecosystems that can be affected by climate change.

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New diversity for conservation: gill flukes of three threatened cyprinids in the Cape Fold Ecoregion

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The global initiative of species conservation has locally been applied in the form of a biodiversity inventory of seven aquatic taxonomic groups under the umbrella project known as REFRESH (Renewing data and filling knowledge gaps for freshwater species of South Africa) to update knowledge and inform conservation efforts. Despite their considerable contribution to the biomass of ecosystems and function across trophic levels, aquatic fish parasites have to date been largely ignored during conservation studies. Parasites are, however, essential candidates in the application of the conservation of ecosystems as well as host and parasite systems. During the present study three new freshwater fish parasite species were discovered. The polyopisthocotylan *Paradiplozoon* sp. were found on the gills of the near threatened (NT) sawfin *Cheilobarbus serra* (P = 66%, IF = 1–6) and Clanwilliam redfin *Sedercypris calidus* (P = 66%, IF = 1–8), while monopisthocotylans of the genera *Dactylogyrus* sp. and *Gyrodactylus* sp. were found from the gills of the also NT Clanwilliam yellowfish *Labeobarbus seeberi* (P = 66%, IF = 1–111) and *C. serra*, respectively. This study presents the morphological description and molecular placement, as well as the first records of these parasites from threatened endemic freshwater fish species in South Africa. It further emphasises the potential of biodiversity discovery in and on neglected taxonomic groups as well as in ecosystems with biased conservation priorities focusing on a selected suite of factors considered for informing management.

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A summary of recent parasitic flatworm (Trematoda) collections in marine waters off Namibia

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The marine trematode fauna of south-western Africa is among the least well understood in the world, with just two recorded species from the region incorporating the coast of Namibia and western South Africa, and these records having been made over 50 years ago. This presentation summarises the findings of a recent (August 2023) parasitological survey of four species of fishes common on the Namibian coast, with emphasis on the trematode fauna encountered. This includes a new genus and species of lepidapedid from the galjoen (*Dichistius capensis*), potential new species from three trematode families (Lecithasteridae, Opecoelidae and Zoogonidae), a range extension for the fellodistomid *Proctoeces maculatus* and the first records of intermediate-stage trematodes of the family Bucephalidae for the country. The implications of these findings for our understanding of the systematics and ecology of their respective groups will be discussed.

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Molecular and morphological characterisation of South African freshwater fish blood parasites of the genus *Trypanosoma* Gruby, 1843 of South Africa

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A considerable number of extracellular, flagellate, single-celled, and obligatory blood parasites fall within the genus *Trypanosoma*. These species have been identified in all vertebrate classes on every continent, excluding Antarctica, and are causative agents of trypanosomiasis, a severe and sometimes fatal disease in both domesticated animals and humans. Despite this, there is a lack of comprehensive research on the trypanosomes found in fish, with limited studies researching their complete life cycles and ecological interactions. Fish hosts possess the potential to aid in advancing knowledge on the transmission of zoonotic trypanosomiases and offer valuable insights into the distribution ranges of species of *Trypanosoma* and their vectors that is integral to biodiversity conservation and management of fisheries and aquaculture. Furthermore, the precise phylogenetic placement of numerous species of *Trypanosoma*, in particular those in fish hosts, remain unconfirmed. Hence this project aims to provide detailed molecular and morphological characterisation of fish trypanosomes in order to elucidate their biodiversity and systematics in South Africa. Blood was collected from 26 species and 15 families host fishes at rivers in the Olifants-Doorn River system, the Letaba, Crocodile and Vaal rivers and Tzaneen Dam from 2022 to 2024. Giemsa-stained thin blood smears were screened for trypanosomes and parasites morphologically characterised. Molecular analyses of the 18S rRNA gene region were performed on the whole blood for samples identified as positive via microscopy. Using complimentary morphological and molecular data, *Trypanosoma* species, most probably new to science, are herein described from South Africa.

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Water beetles (Coleoptera) associated with Afrotemperate Forest patches in the Garden Route National Park, South Africa

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Southern Afrotemperate Forest is concentrated in the southern Cape region of South Africa and whilst it is relatively well known botanically, the fauna, specifically the aquatic invertebrate fauna, is poorly documented. The majority of remaining intact forest habitat is contained within the Garden Route National Park (GRNP), which straddles the provincial boundary between the Western and Eastern Cape. This study undertakes a survey of the water beetle fauna inhabiting the GRNP. The aquatic ecosystems within temperate forests of the region are poorly researched from an ecological and biodiversity perspective, despite being known to harbour endemic invertebrate elements. We collected water beetles and in situ physico-chemical data from a total of 31 waterbodies across the park over two seasons in 2017. The waterbodies sampled were mostly small freshwater perennial streams and isolated forest ponds. A total of 61 beetle taxa was recorded (29 Adephaga, 32 Polyphaga) from these waterbodies. The water beetle fauna of these forests appears to be diverse and contains many species endemic to the fynbos-dominated Cape Floristic Region, but very few of the species appear to be forest specialists. This is in contrast to the fynbos heathland habitat of the region, which harbours a high number of water beetle species endemic to this habitat, often with Gondwanan affinity. Our study is the first to document the water beetles of Afrotemperate Forests in the southern Cape region and provides an important baseline for future work on such habitats in the region and in other parts of southern Africa.

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Predicting the potential distribution of a notorious Thiaridae snail, *Tarebia granifera* in South Africa using ensemble models

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Tarebia granifera, is a freshwater snail from the Thiaridae family originating from Asia, invasive in brackish and freshwater environments in Africa, North America ,The Caribbean, Europe and Israel. *Tarebia granifera* was first reported in South Africa in Mandeni reservoir in 1999 and has since established populations in northern KZN, Mpumalanga, and Limpopo including neighbouring countries like Eswatini, Mozambique and Zimbabwe. One notable characteristic of this snail is its ability to release chemical metabolites that act as deterrents against other competitors (native benthic invertebrates), giving it a competitive edge in terms of space and resources. The main objective of this study was to assess the potential expansion of *T. granifera* from known distribution and map areas at risk of invasion for management purposes in South Africa. We employed a Species Distribution Models (SDMs), to map the potential range expansion of *T. granifera* in South African aquatic systems based on in-situ water quality parameters. Water temperature showed a positive correlation to *T. granifera* alien range shift and expansion. Thus, with increased global change and changes in temperature and precipitation, *T. granifera* will continue to strive and expanding its alien range. This could result in a significant reduction in available habitat and resources for native snail species. To minimize the negative impacts of invasive species, it is crucial to implement targeted surveillance efforts in high-risk areas to detect invasive snails before they become established and further spread. The costs associated with controlling and managing these invasive snails can be minimized.

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Response of macroinvertebrates to restoration of previously invaded freshwater systems: A whole pond experiment

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Freshwater habitats, though less abundant, host significantly higher biodiversity per surface area compared to terrestrial and marine ecosystems. However, these ecosystems face considerable environmental threats due to habitat alterations and biological invasions, leading to adverse effects on aquatic biodiversity. Invasive alien aquatic plants (IAAP) have particularly detrimental residual impacts, often favouring the colonization of other IAAP over native plant species after the management of the target invader. Ecological restoration is thus imperative to mitigate these threats to biodiversity and rehabilitate ecosystem structure, and functioning. This study investigates; (1) the impact of IAAP on aquatic macroinvertebrate diversity and composition, before, after invasion and during revegetation, specifically (2) how active native revegetation including priority effects i.e. timing of arrival of native plants at a site, plant identity and diversity affects macroinvertebrate communities. A whole pond experiment in a split-plot design was performed, where macroinvertebrates were sampled monthly over 13 months, together with water quality parameters, and aquatic plant communities. Aquatic macroinvertebrate community analysis is currently underway; however, we expect higher diversity of macroinvertebrates to be associated with higher diversity of native plants after revegetation. While effective control measures can mitigate immediate IAAP impacts, restoration efforts are crucial for the long-term health and resilience of freshwater ecosystems. Restoring the natural balance of these systems is essential for native species recovery, water quality improvement, and the sustainability of ecosystem services. A comprehensive approach integrating control and restoration strategies is imperative for lasting benefits and to prevent IAAP re-establishment in treated areas.

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Freshwater snails of Africa: A systematic review to show trends in the past 100 years of research

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Globally, freshwater ecosystems are threatened, and studies estimate rapid degradation compared with terrestrial and marine ecosystems. Like most other tropical regions, Africa still has far to go regarding discovery and documentation. Using a systematic review process, we evaluated freshwater African snail studies. We assessed freshwater snail publications from 1946 – 2023 to quantify trends regarding snails as vectors of diseases, ecology, genetics, taxonomy, pest control and invasive alien species in 54 African countries. Freshwater studies in Africa have increased progressively through the decades, with 22 % of studies conducted in the last eight years. Most studies on African freshwater snails were conducted in the Democratic Republic of the Congo (8.8 %), followed by South Africa (8.7 %) and Tanzania (7.4 %). Studies on freshwater snails conducted across African countries were disproportionally high, with the top four countries contributing (31.1 %) of freshwater snail studies. Most freshwater snail study objectives related to parasitic infections (52.5 %), followed by ecology (22.3 %), with genetics/molecular studies receiving significant focus as well (11.5 %). Other studies focussed on pest control (6.7 %), followed by taxonomy (5.2 %), and invasive biology (1.8 %). South Africa appears to be the only African country where research and education institutions have dedicated staff actively working on molluscs, and some mollusc collections have been well preserved. It is recommended that capacity building, collaboration, and increasing institutional support from academic institutions and funding agencies change the situation so that more and more African malacologists can study freshwater molluscs.

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The seasonal response of freshwater macroinvertebrates biodiversity to land use practice in the upper catchment of uMngeni River, South Africa

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Freshwater macroinvertebrates' biodiversity and distribution contribute vital insights about the effect of anthropogenic activities in rivers. Anthropogenic land use activities associated with rivers impact water quality and can be reflected in the freshwater macroinvertebrates' communities. In South Africa, freshwater macroinvertebrate communities are known as indicators of ecological disturbances. In this study, we assessed the response of freshwater macroinvertebrates communities to forestry, pastural land, and indigenous forest land uses in the uMngeni River upper catchment. We collected macro-invertebrates using the South African Scoring System version 5 with post-analysis for species identification in the lab. The collection occurred at four local level sites over five sampling visits in 2023 across all four seasons. It included an additional sampling period between the high flow and low flow periods in April. The species indices (Shannon index, Margalef's index, and Simpson's index) will be used for indicator species. Generalised linear mixed models will be used to identify differences in species richness, assemblage composition, and response to disturbances and stressors. Species diversity coverage will be determined using iNEXT online software. The indicator taxa and habitat associations for each isotope will be identified using the indicator value model. Findings will indicate the impact of land use on the biodiversity of freshwater macroinvertebrates in the upper uMngeni River in KwaZulu-Natal.

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Do urban rivers provide sanctuary to macroinvertebrates? A case study of an urban stretch of the Apies River in Pretoria, South Africa

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Urban rivers are regarded as futile streams due to poor habitat availability, high aggregate of solid wastes and poor water quality. However, they are important ecological corridors supporting aquatic biota diversity. The present study was undertaken to investigate the importance of the urban Apies River in providing habitats for aquatic biota and the spatial variability along the longitudinal gradient. Sampling was conducted between December 2019 – March 2020 and between February 2021 and December 2022. The water exhibited neutral to slightly alkaline pH in all sites throughout the study ($p>0.05$), whereas significant differences were observed for nutrients and sulphate levels ($p<0.05$) between the three sites. The nutrient levels exhibited oligotrophic, eutrophic, and mesotrophic conditions at sites 1, 2, and 3, respectively. Moreover, macroinvertebrates assemblage showed an association with habitat scores and water quality. The diversity was relatively higher at sites 1 and 3 compared to Site 2. However, sensitive taxa were associated with the headwaters, whereas tolerant taxa were associated with sites 2 and 3. The average score per taxon ranged from 4.88 – 5.68, 3.27 – 4.07, and 3.83 – 4.61 at Sites 1, 2, and 3, respectively. The urban Apies River provides sanctuary to tolerant taxa which is not good for biodiversity integrity.

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Impact of weirs in altering benthic macroinvertebrate assemblages and composition structure in the Luvuvhu River Catchment, South Africa

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Stream flow weirs disrupt river flow regimes, physical conditions, and biological composition of rivers, posing significant threat to the river's functionality, integrity, and sustainability. The Luvuvhu River Catchment (LRC) is home to diverse aquatic organisms but lacks an impact assessment of weirs. The study aimed to analyse the influence of six weirs on the composition and assemblage of aquatic macroinvertebrate species in five distinct streams. Six sampling surveys were conducted on macroinvertebrates and physico-chemical parameters upstream and downstream of six weirs between June 2021 and June 2022. The SASS score and average score per taxon (ASPT) indices were utilized to assess organisms' responses to weirs upstream and downstream. The study utilised GLMM and CCA statistical tools to analyse the impact of physico-chemical variables on macroinvertebrate assemblage and compare similarities between sampling points across different sites. The survey observed 18,914 macroinvertebrate individuals from 65 families. In upstream sections, the SASS score was driven by habitat integrity, electrical conductivity, and water depth, while ASPT responded significantly to habitat integrity, pH, dissolved oxygen, and electrical conductivity. The SASS score in downstream sections increased with habitat integrity score and river width, decreasing with elevation and pH levels. The ASPT increased with improved habitat integrity and elevation in downstream sections, while decreasing with increased river width and water temperature. The study indicates that habitat integrity significantly influences aquatic abundance and assemblage in the LRC, emphasizing the necessity to preserve river ecological integrity.

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Accelerating environmental flow implementation to bend the curve of global freshwater biodiversity loss

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Environmental flows (e-flows) aim to mitigate the threat of altered hydrological regimes in river systems and connected waterbodies and are an important component of integrated strategies to address multiple threats to freshwater biodiversity. Expanding and accelerating implementation of e-flows can support river conservation and help to restore the biodiversity and resilience of hydrologically altered and water-stressed rivers and connected freshwater ecosystems. While there have been significant developments in e-flow science, assessment, and societal acceptance, implementation of e-flows within water resource management has been slower than required and geographically uneven. This paper presents e-flow implementation as an adaptive management cycle enabled by 10 factors: legislation and governance, financial and human resourcing, stakeholder engagement and co-production of knowledge, collaborative monitoring of ecological and social-economic outcomes, capacity training and research, exploration of trade-offs among water users, removing or retrofitting water infrastructure to facilitate e-flows and connectivity, and adaptation to climate change. Recognising that there may be barriers and limitations to the full and effective enablement of each factor, the authors have identified corresponding options and generalizable recommendations for actions to overcome prominent constraints, drawing on the case studies and wider literature. The urgency of addressing flow-related freshwater biodiversity loss demands collaborative networks to train and empower a new generation of e-flow practitioners equipped with the latest tools and insights to lead adaptive environmental water management globally. Mainstreaming e-flows within conservation planning, integrated water resource management, river restoration strategies, and adaptations to climate change is imperative.

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Toxicity Assessment of Di(2-ethylhexyl) Phthalate Using Zebrafish Embryos: Cardiotoxic Potential

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Plasticizers are considered as newly emerged contaminants. They are added to plastics to increase their flexibility and softness. Phthalate plasticizers including the Di-2-ethylhexyl phthalates (DEHP) are toxic and induce adverse effects on the different organization levels of the environment. In the current study, we investigated the potential toxicity of DEHP using Zebrafish as a biological model. Five ascending concentrations of DEHP were tested in embryos throughout 96 hpf: 0.0086, 0.086, 0.86, 8.6, and 86 mg/L. Embryotoxicity assessments revealed limited lethal effects on DEHP-exposed embryos, yet notable anticipation of the hatching process was observed at 48 hpf. Although DEHP showed negligible influence on the length of exposed embryos (BL), it led to multiple bodily deformities. Gene expression analyses of key cardiogenic and inflammatory genes evidenced alterations in *tbx20*, *bcl2*, and *il1b* expression in Zebrafish embryos at 96 hours post-fertilization (hpf). Results from the cardiac function analysis displayed that DEHP significantly affected the Arterial Pulse (AP) and Linear Velocity (LV) within the Posterior Cardinal Vein (PCV) of exposed fish. These findings strongly advance that even at low concentrations; DEHP can be considered as potential toxic agent, capable of inducing cardiotoxic effects.

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An assessment of the relationship between total mercury levels in the environment and lipid peroxidation in freshwater snail *Helisoma duryi*

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Economic challenges in developing countries have resulted in more people turning to artisanal gold mining as a means of survival. Mining activities have been known to release toxic elements like mercury into the environment. Hence, this study aimed to determine the relationship between levels of mercury in the environment and malondialdehyde concentrations in the freshwater snail *Helisoma duryi* exposed to water samples collected from in dams in areas with gold mining activities. Water, sediment and plant samples were collected from three dams and physicochemical parameters were measured on site. Freshwater snail *Helisoma duryi* was exposed to water collected from the dams and the malondialdehyde assay was used to determine the level of lipid peroxidation. Bioaccumulation levels of aquatic plants collected from the water bodies were also determined. Low levels of malondialdehyde concentration were observed for snails exposed in water from all dams. Plant samples collected from two of the three dams showed properties of metal accumulators as the leaves had a high concentration of mercury compared to the sediment. Of interest was that high levels of mercury were observed in the roots and leaves of the plant samples. In conclusion, this study showed that some aquatic plants can remove mercury from sediment, however there is still aa danger for the organisms that consume those plants as they may be affected by mercury toxicity.

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Assessing levels of metals and polycyclic aromatic hydrocarbons (PAHs) and their biomarker effect in *Perna perna* from KwaZulu-Natal north coast

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Over the last two centuries, aquatic environments have been subjected to severe threats because of agricultural development, technological disruption of industrial revolution, and increasing population. Particularly, the import of metals and PAHs in coastal regions are of great concern because of their persistence, biomagnification, bioaccumulation in tissues of organisms, and toxicity. This study used the GC-FID and ICP-OES to respectively assess and compare the PAHs (Acenaphthylene, Anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Fluoranthene, Indeno(1,2,3-cd)pyrene and Pyrene) and metals (Cr, Cu, Fe, Pb, Ni, Zn, Mn) in water, sediments, suspended particulate matter (for metals only) and in soft tissues of *Perna perna* from uThukela Beach, uMvoti Estuary and Sheffield Beach. It further anaylsed acetylcholinesterase (AChE), metallothionein and cellular energy allocation (CEA) to assess the biomarker effect of stress in mussels. Sheffield Beach recorded high total PAHs in water and in mussels than the other systems, with highest concentrations of the carcinogenic high molecular weight PAH in mussels. Only Ni was significantly high ($p<0.05$) in mussels from uMvoti Estuary, and the rest of the metals had almost equal concentrations with slightly high concentrations in uMvoti Estuary. The contamination of uMvoti Estuary was shown by significant low AChE activity and CEA in mussels from uMvoti Estuary compared to the other sites with those from Sheffield Beach showing favourable conditions regardless of the PAHs recorded in mussels from this system. The obtained results from uMvoti Estuary were attributed to input of effluents from the adjacent industrial activities, wastewater treatments, run-offs from the sugarcane farms and informal settlements.

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Stable sulfur isotopes from fish tissue as an ecotoxicological tracer of riverine stressors

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Aquatic ecosystems receive sulfur inputs from multiple terrestrial land-use sources. Little is known regarding how stable sulfur isotopes in fish tissue respond to a range of terrestrial stressors. Using a multi-scaled modelling approach while accounting for confounding inputs, the relative effects of these stressors on fish tissue $\delta^{34}S$ values were assessed to disentangle their unique effects in river systems. Samples were collected from 14 sites across two rivers during wet and dry seasons in the Gwathle River Catchment, located in the Platinum Belt of South Africa. The proportion of each terrestrial stressor was quantified within the catchment. Among the water quality parameters measured concurrently with tissue sampling, total dissolved solids emerged as a key indicator of catchment stress, predicting fish tissue $\delta^{34}S$ values. Biplots of TDS and $\delta^{34}S$ showed clustering of river sites experiencing specific stressors. Statistical models revealed that agricultural activity led to relatively enriched fish tissue $\delta^{34}S$, and mining resulted in depleted $\delta^{34}S$ values. It is likely that sulfur-containing fertilizers and livestock manure, which contain S-products enriched in ^{34}S relative to natural inputs, enter aquatic ecosystems through leaching and run-off. In addition, discharged mine tailings into the aquatic ecosystem, may experience in-channel bacterial sulfate reduction producing S-products depleted in $\delta^{34}S$. Mine wastewater seepage into adjacent mediated wetlands, influenced by aquatic macrophytes, also produces S-products depleted in $\delta^{34}S$. This research presents a resource tool for disentangling catchment stressors and identifying likely sulfur polluters, which can inform adaptive catchment management strategies.

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A microcosm approach to determine the responses of macroinvertebrates and zooplankton community structures to imidacloprid and deltamethrin exposure

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Pesticides are widely used to meet the food demands of a growing population, with various types used to control pests depending on the crops grown. Rainfall, overspray, and runoff from agricultural fields can wash these pesticides into water bodies, posing risks to the environment. This study examined two widely used insecticides, deltamethrin and imidacloprid, which are regarded as moderately hazardous. Limited studies in South Africa have linked pesticide levels to responses on aquatic and terrestrial ecosystems. This study assessed the effects of these two pesticides to aquatic macroinvertebrates and zooplankton communities under field-realistic conditions using a microcosm approach. A microcosm is an artificially constructed test system that simulates natural ecosystems. This study consisted of a 16-week exposure period and pesticides were applied at week 0, 2, 4 and 6 and then left for another 10 weeks to determine if recovery occurred. Macroinvertebrates were collected from the sediment, pebble baskets, plants and water column at week 0, 2, 4, 8, 12 and 16, while zooplankton were collected every 2 weeks from the water column. The results indicated that at higher concentrations these communities are severely impacted. Culicidae and scrapers (snails) were able to tolerate these compounds and thrive. . These effects persisted and full recovery of these systems did not occur during this study. It is possible that recovery may take place given a longer period since these insecticides have a shorth half-life and break down due to photolysis.

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Photoelectrocatalytic degradation of emerging organic pollutants in water on an FTO/$BiVO_4$/NiS photoanode

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This study demonstrates the facile synthesis of bismuth vanadate-nickel sulfide ($BiVO_4$/NiS) heterojunction via a solvothermal process coated on a fluorine-doped tin oxide (FTO) substrate for photoelectrochemical (PEC) degradation of sulfamethoxazole (SMX) and Rhodamine B (RhB). The two semiconductors were rationally designed for the p-n heterojunction as it enhances the charge-separation and light-absorbing properties for efficient degradation of organic pollutants. The successful preparation of the $BiVO_4$/NiS composite was confirmed using structural, morphological, and optical analysis such as X-ray diffraction (XRD), transmitted electron microscopy (TEM), energy dispersive X-ray analysis (EDX), scanning electron microscopy (SEM), ultraviolet–visible diffuse reflectance spectroscopy (UV-DRS). The electrochemical and photoelectrochemical properties were investigated using electrochemical impedance spectroscopy (EIS), Mott-Schottky (M−S), and photocurrent response. Compared with the individual components, the FTO/$BiVO_4$/NiS photoanode showed an enhanced photocurrent response of 0.4 mA/cm^2 at 1.5 V potential, 16 and folds higher than the pristine $BiVO_4$. The composite showed a band gap of 1.9 eV, 2.28 eV, and 2.18 eV for the FTO/NiS, FTO/$BiVO_4$, and FTO/$BiVO_4$/NiS, respectively. Moreover, the PEC degradation of the two analytes indicated that the FTO/$BiVO_4$/NiS photoanode successfully degraded SMX (58%) and RhB (73%) in 120 min time intervals with a rate constant of 0.00755 min^{-1} and 0.108 min^{-1}. Scavenger studies revealed that holes and superoxides were significant contributors to the mineralization of the analytes.

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Hydrothermal synthesis of BN-NRGO composites for photocatalytic degradation of PFOA and PFOS

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Access to potable water is scarce worldwide, and water sources are being polluted through anthropogenic activities. Among many other water remediation strategies, sustainable remediation using economical techniques is key to addressing this problem. Advanced oxidation procedures based on photocatalytic degradation of micropollutants using graphene-based semiconductor photocatalysts have shown a plausible technique. This is due to their high surface area and capability to generate active charge carriers when irradiated with suitable light energy. However, drawbacks such as high recombination rates of photogenerated charges, ease of agglomeration, and the wide bandgap in some photocatalysts hinder the effective removal of pollutants in water. In this study, hexagonal boron nitride (BN) was synthesized using the chemical vapor deposition method, and to further improve its photocatalytic properties, nitrogen-doped reduced graphene oxide (NRGO) was composited while varying the ratios by hydrothermal synthesis at 180◦C for 12 hours to form BN-NRGO composites. These composites were characterized using FTIR, SEM-EDX, UV-VIS, and Raman spectroscopy to investigate their physiochemical and optical properties. The as-synthesized BN-NRGO (1-3) photocatalyst ratio achieved 56% removal efficiency of perfluorinated compound PFOA and 99% PFOS after 150 mins of irradiation. However, degradation efficiency increases at pH 2 and decreases at an increase in pH from 8 to 10. The degradation products show no phytotoxic effects on *lactuca Sativa*. Thus, BN-NRGO can be used as a potential photocatalyst for the sustainable remediation of persistent organic micropollutants in wastewater.

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Feeding morphology traits as predictors of food competition among Cichlid species in the Nkomati River System, Mpumalanga, South Africa

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Organisms that utilise the same habitats compete for resources and this is exacerbated if there are similarities in their ecological requirements. Feeding morphology differences play a crucial role in facilitating resource partitioning and coexistence among species. Research focusing on functional feeding traits provides valuable insights into predicting food web structures. *Oreochromis mossambicus, Coptodon rendalli,* and *Chetia brevis* are the focal species in this study. As per the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, these species are categorized as vulnerable, least concern, and endangered, respectively. This study uses feeding morphology and dietary capabilities to explain their population dynamics in the Nkomati River system. Results showed that the feeding morphology of *C. rendalli* highly overlaps with *O. mossambicus* suggesting the potential for overlapping diets. *Chetia brevis* is predicted to be a generalist feeder due to its position in the PCA diagram. The species is also predicted to have less preference for small prey (zooplankton) due to large gill raker length and distance and possible predator due to high teeth numbers. The long guts observed in *O. mossambicus* and *C. rendalli* suggest a longer digestion time correlating with herbivorous feeding behaviours. Previous study in the Limpopo River show that though both species incorporate macrofauna the former specialises on vegetative detritus and periphyton while the latter specialises on macrophytes and periphyton. Dietary analysis will also be used to further explain the decline of *C. brevis* and *O. mossambicus*. However, predation can be another factor contributing to their decline.

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Precision of age determination from otoliths, scales, and vertebrae of *Oreochromis mossambicus* (Peters, 1852) from an irrigation impoundment in the Sundays River Valley, Eastern Cape, South Africa

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Understanding the age and growth patterns of freshwater fishes is crucial for effective fisheries management, habitat conservation, understanding their biology, and ecosystem preservation. Hard structures such as otoliths, scales and vertebrae record life history information in the form of annuli, increments, or other identifiable patterns, providing a wealth of data for researchers and fisheries managers. According to best of our knowledge, there is currently no published information that is available on the precision of age estimates from different aging structures in *Oreochromis mossambicus*. Thus, the present study aims to compare and select the suitable skeletal structure or reliable age estimation in the most important fisheries and abundant fish within the Sundays River Valley irrigation ponds, Eastern Cape. A total of 73 specimens of *O. mossambicus* were collected using seine and fyke nets. The fish ranged from 101 – 305 mm and 113 – 332 mm total length (T_L) for females T_L and males, respectively. Otoliths were more readable than vertebrae followed by scales. Otolith readings were more precise (average percentage error (APE) = 17.7%; coefficient of variation (CV) = 19.2%) than vertebrae (APE = 19.3%; CV = 20.1%) and scale (APE = 20.1%; CV = 21.0%). Growth was described by the three parameter von Bertalanffy model as $L_t = 241.5\,(1\text{-}e^{-1.09(t+\,0.38)})$ mm T_L and $L_t = 233.9\,(1\text{-}e^{-0.72(t+\,0.57)})$ mm T_L for females and males, respectively. Vertebrae and scales are therefore not suitable structures for ageing *O. mossambicus* from artificial impoundments.

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Assessing ecological integrity using FRAI in uMngeni region, KwaZulu-Natal

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Stressors from the increasing demand for water and other aquatic resources are degrading freshwater ecosystems. These ecosystems are under tremendous pressure to support highly populated urban centres, industry, and agricultural activities in KwaZulu-Natal Province, South Africa. Rivers such as the uMsunduzi and uMngeni are of great socio-economic importance as they supply essential ecosystem services, for example, water provision and remedial processes. The ecosystem-based fish response assessment index (FRAI) was used to assess the impacts of changes in habitat, cover, flow, and water quality parameters on fish seasonally in these rivers in 2022 and 2023. Compared with the pristine condition site, the composition of fish communities along the uMngeni catchment changed because of negative impacts associated with multiple stressors, including changed flow, loss of habitat, changed physico-chemical water properties, dams, and invasive species. The upper uMngeni Catchment was dominated by brown trout *Salmo trutta*. The lower sections of the uMngeni Catchment had fish species that were tolerant of pollution, altered flows, and invasive fish, such as largemouth bass *Micropterus salmoides* and common carp *Cyprinus carpio*. More efforts are needed to improve the rivers' ecological status, targeting associated stressors derived in the study. Awareness must be raised to conserve species native to the uMsunduzi and uMngeni catchment, especially around the potential loss of expected species not detected.

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An assessment of the fish diversity of the Waterberg District, Limpopo Province

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The Waterberg District contains a sandstone massif that provides a watershed for several critical tributaries feeding the western Limpopo River basin. This area is characterised by minimal industrial development and a large number of provincial and privately owned conservation areas, making it a potential biodiversity hotspot for aquatic fauna in the water-scarce Limpopo Province. Between 2021 and 2023, the Foundational Biodiversity Information Programme supported a multi-institutional team to conduct extensive surveys assessing the taxonomic and phylogenetic diversity of fishes within the four major tributaries of the Limpopo River that drain the Waterberg mountains. Our surveys recorded 30 native species and two non-native species of fish. Preliminary DNA barcoding results have identified taxonomic conflicts within four species, *Clarias theodorae*, *Enteromius brevipinnis*, *E. palludinosus* and *E. bifrenatus*, suggesting existence of at least four candidate species from the Waterberg. These discoveries provide key evidence to support the taxonomic revision of these species. We also found the alien invasive largemouth bass (*Micropterus salmoides*) to be established in several tributaries of the Mokolo River. While this represents a threat to small-bodied native species in the catchment, the range of this invasion is restricted to within the Waterberg Biosphere Reserve, which provides a potential avenue to gather stakeholder support for invasive species control in the future.

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Hidden in the riffles: Three new suckermouth catfishes (Mochokidae, *Chiloglanis*) from the Great Dyke and Eastern Zimbabwe Highlands

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Suckermouth catfishes of the genus *Chiloglanis* Peters 1868 are small riffle-dwelling fishes endemic to Africa where they have a wide geographic range extending from the Pongolo River in the south to the Nile River in the north. Currently, there are only eight valid *Chiloglanis* species within southern Africa. Seven of them have relatively narrow geographic distribution ranges except for *C. neumanni*, which is considered to be widely distributed, occurring from the Buzi River system in the south, and its northern limit being the eastward draining river systems in Tanzania. Recent studies on the diversity within *Chiloglanis* have identified the presence of high levels of hidden diversity, indicating that the current taxonomy of this genus largely underestimates the number of species within it. The present study examined the extent to which the current taxonomy obscures the diversity of riffle-dwelling suckermouth catfishes in the genus *Chiloglanis* in southern Africa. Integration of genetic and morphological data resulted in the description of two new species of *Chiloglanis* from the Eastern Zimbabwe Highlands (EZH) freshwater ecoregion and a third species from the Great Dyke of Zimbabwe, regions whose ichthyological diversity is poorly explored. Results from this study add to the growing evidence of high levels of undocumented diversity within riffle-dwelling taxa in southern Africa and further highlight the urgent need for conservation of montane streams in the EZH and Great Dyke that are heavily degraded by ongoing extensive mining activities which threaten the future persistence of their unique aquatic fauna.

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Using otoliths to assess effects of environmental stressors on fish growth from two impoundments in South-Africa

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Fish growth is a fundamental biological process that is linked to an individual's metabolic condition, life history and trophic interactions. Understanding species-specific growth patterns and the environmental factors influencing growth rates provides key ecological and evolutionary insights. The study aimed to understand the intricate relationship between fish and their surrounding environment, with a focus on the influence of environmental stressors on growth. The methods employed in this study involved analysing growth rates, trace element concentrations, and nutrient variations in two impoundments in North West Province. Three fish species were collected from Olifantsnek and Bospoort Dams between 2017 - 2020 and dissected for their otoliths to determine their growth rates. Trace element and nutrient levels were assessed, and statistical analyses identified significant variations and correlations between growth rates and environmental parameters in each species and impoundment. The results revealed significant variations in growth rates between the two dams, with higher growth rates observed in Bospoort Dam for two out of the three studied fish species. Environmental factors, including nutrient levels, water quality, and ecological dynamics, were identified as potential drivers of fish growth patterns. Furthermore, a correlation was found between age and trace element concentrations, indicating the influence of environmental stressors on the three fish species. Furthermore, older fish exhibited higher trace element concentrations, suggesting prolonged exposure to environmental contaminants. This supported the hypothesis that environmental stressors impact fish growth. The findings from this study aligned with previous research, providing valuable insights into the complex relationship between fish growth rates and environmental stressors.

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Evaluating the efficacy of eDNA metabarcoding for detecting native *Oreochromis mossambicus* populations in KwaZulu-Natal, South Africa

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Environmental DNA (eDNA) metabarcoding is emerging as a powerful tool for monitoring aquatic species due to its rapid, non-invasive, and cost-effective nature. This study investigated its efficacy for detecting native populations of the vulnerable *Oreochromis mossambicus* in KwaZulu-Natal rivers, South Africa. *Oreochromis mossambicus* faces significant conservation concerns, and accurate monitoring methods are crucial for its protection. We employed a multi-marker eDNA metabarcoding approach targeting the cytochrome oxidase I (COI), 12S rRNA, and 16S rRNA gene regions to address challenges associated with intraspecific variation within the tilapia group. Analyses of eDNA samples from nine localities revealed 211 fish-related sequences from 481,913 raw reads. While COI primers successfully detected various fish species, including *O. mossambicus* and *O. niloticus*, achieving species-level identification for all taxa proved challenging (18% confidence). However, the dominance of families such as Danionidae and Claridae in the sequence data demonstrates the method's potential for detecting target taxa. Our findings highlight the promise of eDNA metabarcoding for freshwater fish monitoring, particularly for vulnerable species such as *O. mossambicus*. However, ongoing refinement is necessary to maximize its potential. This includes addressing limitations in reference databases within GenBank and BOLD, which necessitates collaborative efforts to improve data availability for accurate species identification.

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Exploring the evolution and impact of the African Journal of Aquatic Science: A bibliometric analysis from 2008 to 2023

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The African Journal of Aquatic Science (AJAS) has established itself as a leading journal within its field, garnering widespread recognition for its excellence. This paper aims to conduct an in-depth analysis of 675 documents sourced from the Web of Science (WoS) spanning the period from 2008 to 2023. Employing established bibliometric indicators, the analysis reveals significant insights into the journal's trajectory. The analysis revealed an Annual Growth Rate of -5.57% and an Average Citations per Document of 6.207. Authored by 1476 individuals, these articles produced 2333 Author's Keywords (DE). Notably, 27.56% of the articles exhibited international co-authorships. Keywords such as, 'water quality', 'pollution', and 'fish' emerged as dominant themes, with a shift observed over time. South Africa emerged as the primary contributor, with 332 corresponding authors, followed by Nigeria with 52. Utilizing bibliographic indicators including bibliographic coupling analysis, co-authorship analysis, and keyword co-occurrence, we examined various factors influencing the journal's growth trajectory. Thematic analysis revealed AJAS's consistent focus on contemporary topics, particularly water quality and pollution. Our study unveiled intricate patterns in scientific production, network structure, and collaboration dynamics. These findings shed light on the interplay between different sub-fields within the journal and offer valuable insights into its evolution over time. By providing a comprehensive overview of the journal's performance and thematic trends, this study equips researchers, journal editors, policymakers, and biodiversity managers with valuable information to identify strengths, address research gaps, and guide future studies effectively.

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Expect the unexpected - Mercury in the Incomati River Basin

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The Incomati River Basin is an important transboundary river basin that is a vital source of water for endemic biodiversity, as well as millions of livelihoods. This River Basin is classified as a "stressed" system due to high water demands from environmental flow and anthropogenic activities. These anthropogenic activities have decreased both the water quality and quantity of the river basin. A pollutant of concern in the Incomati River Basin is mercury due to the large number of coal-fired power stations, coal mines and both active and abandoned gold mines in the area. Many studies have been done focusing on the transboundary nature of the Incomati River Basin but very few have been done focusing on mercury contamination. This study measured the mercury concentrations in water, sediment, macroinvertebrates (molluscs, crustaceans and odonates) and liver and muscle tissue from three selected fish species (Oreochromis mossambicus, Clarias gariepinus and *Hydrocynus vitattus*). The mercury concentrations in the fish show the expected trend of increasing as the trophic level of the fish increases (*O. mossambicus* < *C. gariepinus* < *H. vitattus*), with *H. vittatus* having significantly higher mercury concentrations at all sites. The mercury concentrations in the macroinvertebrates did not show any major trends. Unexpectedly, the mercury concentrations were higher at the relatively unimpacted site compared to the impacted site for both macroinvertebrates and fish tissue. This study aims to increase the knowledge on current mercury concentrations in the Incomati River Basin and how this might impact those that depend on the system.

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The widespread freshwater clam *Corbicula* sp. as potential bioindicator species for mercury pollution in South Africa

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South Africa stands out as a prominent global contributor of mercury (Hg) emissions, a matter of great concern due to its toxic nature and potential serious health effects on biota if it enters the environment. Mercury enters freshwater systems through various anthropogenic activities, such as emissions from coal-fired power stations and artisanal gold mining. Studies have indicated that bivalves can accumulate metals from their aquatic environment. The freshwater bivalve genus *Corbicula* is widely distributed across South Africa and is relatively abundant. Given the widespread presence of *Corbicula* clams in South Africa, they have the potential to serve as bioindicators for Hg pollution in freshwater ecosystems. A total of 35 sites were sampled across the north-eastern part of South Africa, with *Corbicula* clams found at 15 of these sites. At each site, a minimum of five clams were collected, alongside water and sediment samples. Total Hg concentrations were determined in water, sediment and clam samples using a Flow Injection Mercury System. Mercury concentrations in water and sediment samples correlated with different land-use activities, where sites closer to Hg sources had higher Hg concentrations. Different abiotic factors in the different matrices also influenced Hg concentrations, where sites with turbid waters and higher organic matter in sediments correlated with higher concentrations of Hg. As *Corbicula* clams are effective filter feeders, higher concentrations were found in larger clams as a result of higher filter capacity and accumulating Hg via the environment, as well as dietary exposure.

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Metal contamination and polychaete distribution in the Berg River Estuary, South Africa

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The Berg River Estuary, Western Cape, is a significant and ecologically diverse ecosystem, with RAMSAR status. It is surrounded by pollution sources. Polychaetes are used as pollution indicators worldwide, however, locally, this taxon has not received much attention. This study investigated the relationship between metal contamination and polychaete distribution. Metal concentrations in estuarine sediments at nine distinct sites were assessed. Sediment cores were collected, acid-digested and analysed for a range of metals using an ICP-MS. Percentage organic matter content was also calculated in sediment samples. Additionally, polychaetes were isolated from the fresh cores and identified under a stereoscope. Results showed variations in metal concentrations, influenced by natural processes and local human activities. Freshwater influx was found to significantly ($p<0.05$) reduce metal levels, while industrial and recreational activities, agricultural run-off and concomitant increased sediment organic matter loads, were found to increase metals in the middle of the estuary ($p<0.05$). Industrial activities and the altered estuary mouth contribute to consistently elevated metal concentrations at the artificial mouth. Preliminary polychaete results showed that dominant polychaete families such as Spionidae, Nereididae, and Capitellidae exhibit varying degrees of sensitivity or tolerance to pollution. The *Capitella capitata* complex emerged as a pollution-tolerant species, *while Prionospio sexoculata* display sensitivity to higher metal concentrations. By addressing the pressing need for localized research in this area, the study contributes to a more comprehensive understanding of estuarine health and pollution dynamics. This research holds implications for estuarine preservation and sustainable management practices, guiding future conservation efforts in South African estuaries.

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Characteristics and spatio-temporal trends of PFAS pollution in South Africa's aquatic environments

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Polyfluoroalkyl substances (PFASs) are fluorinated compounds that are biaccumulative, persistent, have long range transport characteristics and are toxic. In this study, the spatial and seasonal distributions, and concentrations of legacy and emerging PFASs in different water sources in pre-selected cities from all the nine provinces in South Africa were investigated. Water samples were collected during wet and dry seasons from wastewater treatment plant, drinking water treatment plant effluents, surface water, groundwater and tap water. PFASs were extracted from the waters using SPE and LC-MSMS tandem was used for analysis. In dry season, ∑PFAS levels varied between 8.21-383.22, 16.33-433.72, 0.08-261.84, 39.90-1146.28, and 0.46-252.06 ng/L in groundwater, tap water, surface water, WWTP and DWTP effluents, respectively. FOET was prevalent in surface water, WWTP and DWTP effluents. In wet season, ∑PFAS levels varied between 1.38-187.45, 5.84-248.94, 0.74-234.79, 35.09-945.59, and 11.16-245.71 ng/L in groundwater, tap water, surface water, WWTP and DWTP effluents, respectively. In wet season PFBA was prevalent in groundwater, surface water and DWTP while PFHxDA was prevalent in WWTP effluent. Seasonal variation on the concentration levels of PFASs in the water samples across all the provinces was noticeable. Higher concentrations of certain PFASs compounds were observed in dry season in some water systems while other PFASs were high in wet season depending of each province. This study highlights the importance of monitoring PFASs in South African water sources and the need for effective water management strategies.

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Mercury contamination in South Africa's aquatic ecosystems: Any cause for concern?

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Mercury (Hg) contamination in various aquatic ecosystems is a major concern as global emissions are increasing. These Hg emissions enter aquatic ecosystems via various anthropogenic sources, including artisanal gold mining, stationary coal combustion and non-ferrous metal production. All of these major sources of Hg are occurring in South Africa (SA), resulting in SA to be one of the top ten contributors of Hg emissions globally. When Hg enters the environment, it does not only act as a local contaminant but can be transported by long-distance atmospheric deposition, where it can readily be accumulated in biota and biomagnify in food webs. This study determined the current Hg contamination status of SA in freshwater and marine ecosystems by assessing various environmental matrices and the transfer of Hg in the environment. It is evident that Hg concentrations in SA increased in both the freshwater and marine environment over the last decade and is represented in biota from these systems. When applying the USEPA human health risk assessment to consumption of fish, it was found that Hg can pose non-carcinogenic health risks. These risks were recorded in freshwater fish collected from the Limpopo, Olifants, Vaal Major, Orange, and Pongola-Mtamvuna water management areas of SA, while marine species collected from the south coast of SA also pose health risks. The present study highlights a number of factors that need to be considered when assessing human health risk such as increased routine monitoring, actual fish consumption patterns, etc.

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Rethinking approaches to safer fish consumption in southern Africa: Lessons from mercury contamination in fish from two reservoirs in Zimbabwe

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Fish consumption provides both nutritional and recreational human health benefits. However, high levels of toxic environmental contaminants such as mercury (Hg), polychlorinated biphenyls (PCBs), and per- and polyfluoroalkyl substances (PFAS) in freshwater systems have prompted the issuance of fish consumption advisories by human health and environmental agencies in many parts of the world. In Zimbabwe, little is known about the trophodynamics of legacy and emerging contaminants in the country's major reservoirs. We analyzed fish tissues for total mercury (THg) and stable isotopes of nitrogen and carbon ($\delta^{15}N$ and $\delta^{13}C$) to compare patterns of mercury biomagnification between fish in two trophic guilds from a protected reservoir (Chivero) and an artisanal gold mining-impacted reservoir (Mazowe) and assessed consequences for fish and human health. Mercury concentrations were significantly higher for both piscivorous and herbivorous fishes from Mazowe compared to fishes from similar feeding guilds in Chivero. Trophic magnification slopes revealed significant mercury biomagnification in Mazowe and no evidence for biomagnification in Chivero. Over 30% of Mazowe's piscivorous fishes had wet weight THg concentrations that surpassed the threshold for human consumption for both the sensitive and general populations. Our findings highlight the need for environmental and human health regulatory agencies in southern Africa to consider improving risk communication to the fish consuming public in order to reduce human exposure to toxic contaminants. We recommend the calculation and publicizing of fish consumption advisories in the region with recommendations on limiting or avoiding fish consumption from contaminated water bodies.

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Assessment of the sediment quality of the Benin River, Edo State, Nigeria prior to the Seaport development

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Sediments serve as home for bottom dwellers and also important sinks for various pollutants like pesticides and heavy metals. Contaminated sediment can have acute lethal and sub-lethal effect in benthic and other sediment associated organisms. This study was prompted to evaluate the contamination status of the sediment before the seaport development using different indices. Four stations were sampled from the Benin River. Sediment was collected using the Ekman grab and analyzed using standard laboratory procedures ensuring quality control measures. The results showed the sediment to be slightly acidic. Significant variations ($P<0.01$) for the sediment parameters except for Organic Carbon, Organic Matter, Fe, Zn, Cr and Pb were recorded. *A posteriori* Duncan Multiple Range (DMR) test revealed that stations 3 and 4 differed significantly from other stations; Copper, Cadmium and Nickel showed significant variations ($P<0.05$). The sorption capacity varied from 58.440 to 1883.80 kg/l which showed very high sorption capacity (KD>6kg/l) and low mobility of heavy metals in the water with Cu being the least absorbed in Station 4. The indices used in evaluating sediment contamination are: Enrichment Factor (EF), Pollution Load Index (PLI), Geo-accumulation Index (Igeo) and Potential Ecological Risk Index (PERI). Contamination factor ranged from low contamination (Nickel) to very high contamination (Vanadium) showing anthropogenic sources (EF>1). Potential ecological index showed that the sediment was severely impacted (RI>600=Severe). The knowledge of the present sediment status would provide a baseline data for environmental management plan before the intervention of the Seaport development project against which the impact could be evaluated.

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Ecological and human health risk assessment of OPFRs and trace metals in landfill leachate and sediment

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Landfills serve as essential components of waste management strategies but simultaneously pose significant risks to the environment and public health due to the release of organophosphorus flame retardants (OPFRs) and trace metals in landfill leachate and sediment. This study evaluates how concentration, distribution, public health, and the ecology are impacted by pollutants in landfill leachates and sediments from major municipal solid waste sites in Gauteng Province, South Africa. The analysis revealed concentrations of OPFRs ranging from below detection limits (<LOQ) - 533 ng/L in leachate and up to 150 ng/g dw in sediment. Trace metals displayed wide variations, with some concentrations exceeding thresholds known to pose risks to aquatic life. Using Principal Component Analysis (PCA), we identified distinct sources contributing to the contamination profiles, including industrial waste and consumer products. Ecological risk assessments indicated moderate to high risks to aquatic organisms, notably fish, while human health risk assessments suggested that current exposure levels remain below safety thresholds. The findings underscore the critical need for enhanced landfill management practices and regulatory frameworks to mitigate the environmental and health impacts of landfill contaminants. Our study contributes to the broader understanding of landfill-associated pollution and offers evidence-based recommendations for policy and practice improvements in waste management.

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Spring protection for sustainable water supply: A case study of water use and quality within two selected sub-catchments in Kwazulu-Natal Province, South Africa

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In South Africa, 80% of rural communities rely on natural springs to satisfy their water needs. Unfortunately, the quality of spring water is often compromised by a combination of factors including livestock trampling and contaminated surface runoff. Consumption of microbial-contaminated water has severe implications for human health. The project aimed to a) identify natural spring water resources within the uMgeni and uMkhomazi catchments; b) analyse the presence of specific pollutants at the prioritised springs, and c) co-develop interventions to reduce spring pollution. Surveys were conducted in 77 households in four rural communities of KwaZulu-Natal province to determine their water-use practices, perceptions of water quality, and household water-treatment methods. Drinking water samples from abstraction and collection points were tested for physicochemical and microbiological quality in the dry and wet seasons. All participants used spring water for drinking, cooking, washing and cleaning. Except for eMambedweni spring users, over 96% of participants perceived that springs were facing pollution challenges, and over 73% of participants did not treat spring water before use. Water from three springs tested positive for *Escherichia coli* and total coliforms. Relative to the wet season, the densities of *E. coli* and total coliforms were lower in the dry season. Co-developed interventions reduced levels of *E. coli* contamination but not total coliforms. The findings of this study highlighted that rural communities in KwaZulu-Natal rely on poor quality spring water to meet their household water needs. Therefore, local authorities should strengthen spring protection interventions to minimise pollution and improve water quality.

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Investigating the feasibility of phycoremediation for dairy farm and processor facility parlour wastewater in South Africa

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The dairy industry significantly impacts freshwater resources in South Africa, primarily due to the substantial volume of wastewater generated from dairy farming. Despite its economic importance, this poses environmental challenges, exacerbated by the reliance on settling ponds with minimal pre-treatment before irrigation onto pastures. Such practices raise concerns about water quality and subsequent impacts on ground and surface water resources. Biological treatment methods, acknowledged as cost-effective solutions, offer promise for pollutant removal from dairy wastewater. Algae, with its carbon sequestration capability, emerges as a tool for climate change mitigation by absorbing CO_2, generating renewable biomass, and promoting sustainable resource management. However, significant research gaps exist in South Africa regarding on-site treatment technologies, farm-specific variations, and treatment method efficiency. Addressing these gaps is crucial for devising effective wastewater management strategies within the dairy sector. This project aims to conduct wastewater audits and physico-chemical analysis on four commercial dairy farms and two processing plants in South Africa, assessing the feasibility of phycoremediation using algal consortia for wastewater mitigation. Audits revealed deficiencies in monitoring and compliance across all sites. Laboratory experiments demonstrated phycoremediation's potential for treating dairy farm wastewater, though challenges like high turbidity and chemical oxygen demand necessitated dilution for effectiveness, suggesting further research and adaptation. Both activated sludge treatment and phycoremediation showed efficacy, with the former excelling in organic load removal and the latter offering benefits like biomass production and nutrient removal. The findings underscore the importance of incentivizing improved on-farm wastewater management, with field trials necessary to evaluate feasibility in operational contexts.

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Integration of ecological infrastructure into formal urban asset management system: A case of the City of Tshwane Metropolitan Municipality, South Africa

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Ecological infrastructure (EI) to refers aquatic ecosystems that provide ecosystem services. Despite the increasing awareness of their role and importance, few if any formal institutional arrangements, and specifically economic policy instruments, exist which internalise decision-making around these assets. Integrating these natural assets into formal asset management systems can address these problems. The asset management process assists municipalities in preparing successful development plans. This process starts with the asset register, which is why the project aims to bring EI into the municipal asset register. By doing so a financial investment case was made for these assets. A network of wetlands within the City of Tshwane were identified for potential integration into the municipality's asset register. An institutional readiness analysis was then applied to determine the municipality's capacity for integration of EI. The selected wetlands were assessed according to Generally Recognised Accounting Practice definition and recognition criteria of assets. A delineation process was undertaken, and the wetland assets were then classified based on their function and asset type. A financial valuation was conducted for the wetlands, comparing the costs of rehabilitation to the financial benefits derived from the rehabilitation efforts. The financial benefits assessed were property rates, cost savings in water treatment works and useful life extension of stormwater assets. An asset register showing the EI was then developed. The results of the study demonstrated how EI can be integrated into asset management processes. A case for investment was also made as the financial benefits exceeded the rehabilitation costs by 1.8 times.

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Dietary intake and human health risk assessment of neonicotinoid and organochlorine pesticide residues in fish tissues from selected river systems in southern Africa

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The extensive use of neonicotinoids (NNIs) and organochlorine pesticides (OCPs) in South Africa has raised concerns about how they may affect ecosystems that are not intended targets. This study investigates the concentrations of NNI and OCP found in nine fish species collected from the selected river systems in South Africa, and any possible effects they may have on aquatic life and human health. We integrated all NNIs in each fish sample using the relative potency factor (IMI_{RPF}) technique. Imidacloprid was the most frequently detected NNI in the Crocodile River (97% detection). Clothianidin was the highest concentration (2680 ± 1241 ng/g dw) in *Marcusenius macrolepidotus* from Tzaneen Dam (TD). Acetamiprid was detected from all the sites with the highest concentration found in *M. macrolepidotus* from the TD. The highest OCP concentration in *Clarias gariepinus* from TD was p,p'-DDE (311 ± 199 ng/g ww) which is also the most prevalent OCP (100%) in the Sabie River. Given 19412 ng/g imidacloprid-equivalent total NNI, *M. macrolepidotus* had the highest IMI_{RPF} in the TD. The highest IMI_{RPF} values were found in *C. gariepinus* from TD and *Hydrocynus vittatus* from the upper Sabie River, with 7635 and 666 ng/g imidacloprid-equivalent total NNIs, respectively. The hazard ratio values of OCPs were >1, suggesting possible health concerns. The dietary exposure risks for total NNIs should not be disregarded, even though the EDIs in this investigation were significantly lower than the tolerable daily intake. This is because NNIs are widely used in South Africa for agriculture and pest control.

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The probability of DDTs in fish as a risk for prostate cancer (PCa) in men living in the remote Vhembe District, Limpopo Province, South Africa

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Southern Africa (26.8) has the highest prostate cancer (PCa) mortality rates, which is 3.5-fold more significant than the world estimate (7.6) and 2.6-fold greater than Australia/New Zealand (10.2). Men from rural communities were 1.6-fold more likely to present with high-risk PCa than men from metropolitan areas. Risk factors for PCa include older age, family history of disease and African ancestry. Vhembe is a known malaria area where structures are sprayed with Dichlorodiphenyltrichloroethane (DDT) to eradicate the malaria vectors. Levels of *p,p*-DDT, *o,p*-DDT and *p,p*- dichlorodiphenyldichloroethylene (DDE) were measured from fish muscle and water collected pre and post-the malaria high-transmission period (HTP) from water sources where the study population reside to associate these pollutants with PCa. The fish's edible part (muscle), one piece raw and one piece cooked, was tested for DDTs. Fish from the Mutshundudi River had higher DDT residuals than all other sites before the IRS. None of the DDTs were present after the yearly IRS. Daily exposure of DDTs for consumers was estimated by comparing estimated daily intake (EDI) with different criteria. The results revealed that the EDIs in our study were all lower than those criteria. Target hazard quotient (THQ) and risk ratio (R) were used to evaluate non-carcinogenic (toxic) and carcinogenic risks. There was no carcinogenic or toxic risk for humans consuming fish from the Mutale and Mutshindudi rivers and Thathe Vondo Dam. This indicates that DDT, DDD, and DDE in fish do not affect the PCa burden in the Vhavenda men living in remote communities.

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Emissions of the greenhouse gases CO_2 and CH_4 from small dams in Johannesburg, Gauteng

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Small dams play an active role in carbon cycling through the breakdown of organic material and release of the greenhouse gases (GHG) carbon dioxide (CO_2) and methane (CH_4). GHG emissions from waterbodies around the world have been well studied, but there are very few studies in Africa and none in South Africa. Many dams in Gauteng suffer from eutrophication and it is well established that increased nutrient levels may enhance GHG emissions. Internationally, such anthropogenic emissions are reported under the agriculture, forestry and land-use (AFOLU) sector for nationally declared contributions to the UNFCCC. A key challenge in measuring flux rates is the great spatial and temporal variability in GHG emissions. We measured emissions quarterly from six small dams in Johannesburg using floating chambers deployed for one-hour, with multiple sample locations (6-10) per study site. Samples were injected into vacutainers and subsequently analysed by GC for CO_2 and CH_4 concentrations. Results were used to upscale across Gauteng using the surface area of 6,986 dams in a regional GIS inventory. Compared to global syntheses of GHG emissions from dams, Gauteng dams have lower CO_2 emissions but higher CH_4 emissions, with a greater flux rate overall in CO_2 equivalents per meter squared, than the global average. Dams in Gauteng alone could emit 4,402 Gg CO2eq/year, or 15.5% and 14.9% of the forecasted 2020 and 2030 AFOLU GHG inventories for South Africa, but are currently not included. It is likely that national GHG emissions from the AFOLU sector are therefore being underreported.

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Reforestation helps to reduce pollution

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The reforested Buffelsdraai landfill site in Verulam, eThekwini, South Africa was investigated to determine the impact of reforestation based on analysis of selected classes of pollutants in the soil, sediment and river water in the area. Reforestation involved planting of trees from 2010 to 2015 with trees planted in sections over specific time periods. This study looked at polyaromatic hydrocarbons (PAHs) in soil collected from various planting sections, and riparian sediment and surface water from the river flowing through the reforested site. Soil and sediment samples were extracted using ultrasonication and water samples were extracted using liquid-liquid extraction. Analysis was undertaken using gas chromatography-mass spectrometry after method development and validation were carried out. The results showed total PAH concentrations of 4.258 - 6.426 µg g^{-1} in soil samples, 2.210 – 13.900 µg g^{-1} in sediment, and 6.360 – 85.468 ng L^{-1} in river water. A comparison of PAH concentrations in the different reforested areas showed older reforested areas having lower concentrations compared to newer reforested areas as well as compared to control samples collected outside the reforested area. This is the first study showing evidence that supports the positive impact of reforestation.

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Assessing the health of small streams in Mankweng: integrating eDNA analysis for a One-Health perspective

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Small streams are essential components of rural ecosystems, providing critical support for diverse aquatic life and serving as vital water sources for communities. These ecosystems are increasingly subject to human induced environmental stressors, highlighting the need for thorough health assessments. This study explores the application of environmental DNA (eDNA) analysis to establish foundational data for evaluating the health of small streams in Mankweng, South Africa. eDNA analysis offers a non-invasive method to assess biodiversity and ecosystem health. Furthermore, the broader study aims to employ the One Health concept to grasp the intricate interconnections between human, animal, and environmental health in rural areas, with a particular focus on Mankweng Township. Sampling was conducted at six interconnected sites (Sites 1-6) in Mankweng lacking prior biota information. Utilizing iDNature kits, samples were collected and shipped to NatureMetrics (UK) for analysis. 178 families representing various taxa including Vertebrata, Invertebrata, Chromista, Fungi, and Plantae were identified. Site 1 exhibited the highest species diversity and Site 5 the lowest. The detection of numerous disease vectors underscores potential health risks for the community and associated animals. This research emphasizes the necessity of implementing proactive One Health initiatives to improve ecosystem health for all involved. This study provides essential baseline data on the biodiversity in Mankweng, necessary to establish the first comprehensive records for this area. Through interdisciplinary methodologies and case studies, the broader study seeks to emphasize the importance of integrating eDNA analysis into environmental monitoring frameworks for informed decision-making and sustainable management practices in rural settings.

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Preserving the secrets of aquatic ecosystems: The fundamental role of Biobanks

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Aquatic ecosystems represent a multitude of biodiversity, comprising diverse fish and invertebrate species, which play a significant role in ecological, economic and social aspects. Understanding and conserving this biodiversity entails comprehensive research efforts, and can be facilitated by the presence of Museum Collection and Biobank facilities, which serve as invaluable resources for aquatic research by providing a central platform for collecting, storing and curating specimens and their associated tissue samples and data. The National Research Foundation-South African Institute for Aquatic Biodiversity (NRF-SAIAB) hosts a wet collection facility and linked aquatic biobank, which reflects SAIAB's research over the past 50 years. The NRF-SAIAB Biobank has been made the National Aquatic Biodiversity Biobank by the Department of Science and Innovation (DSI) and we are the largest aquatic biobank in Africa and currently hold approximately 45 000 tissue samples of aquatic fish, amphibians and invertebrate species. The Biobank can store a total capacity of 235 224 samples, we are therefore a growing facility that is continually expanding our biological samples. The NRF-SAIAB Biobank is an open access platform and researchers worldwide can request use of samples, hence supporting open science and shared scientific resources. Furthermore, we are a core biobank of the Biodiversity Biobanks South Africa (BBSA), whose main aim is to increase the range and quality of samples stored and distributed in biobanks to improve access for research and development. Ultimately, we highlight the indispensable role of biobanks as critical infrastructure for supporting and enhancing research efforts aimed at aquatic ecosystems.

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It's complicated: DNA barcoding highlights taxonomic challenges in southern African diploid barbs

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The taxonomic status and phylogenetic relationships of small African barbs (Cyprinidae: Smiliogastrinae) remain contentious. Eleven genera of African Smiliogastrinae are currently recognised, the most species rich of which is the genus *Enteromius* Cope, 1867. However, phylogenetic studies to date show *Enteromius* to be paraphyletic with respect to the genera *Barboides* Brüning, 1929, *Caecobarbus* Boulenger, 1921, *Clypeobarbus* Fowler, 1936, and *Prolabeops* Schultz 1941. One solution to the *Enteromius* problem is to identify monophyletic lineages and resolve taxonomic issues within those lineages with an eye on future generic elevation of candidate lineages. Here, we present a DNA barcoding study on African Smiliogastrinae, involving the production of 41 newly generated COI sequences from southern African drainages. Together with 320 sequences published by SAIAB and a further 361 sequences mined from GenBank and BOLD, a dataset of 720 sequences for 111 species was assembled, accounting for 41% of known African Smiliogastrinae species. Within southern Africa taxonomic coverage of *Enteromius* was high, accounting for 88% of known species. Phylogenetic results combined with DNA-based species delimitation analyses delimited 235-262 molecular operational taxonomic units (MOTUs). Concordant with previous phylogenetic studies, three distinct clades were recovered within *Enteromius,* nested within which were the genera *Clypeobarbus*, *Caecobarbus* and *Barboides*. High levels of cryptic diversity was detected in 41 of the analysed species and 10 nominal species of southern African barbs were identified requiring thorough taxonomic revision. Further, the "goldie" and "chubbyhead" barbs of southern Africa formed well supported monophyletic lineages and are candidate groupings for generic elevation and diagnosis.

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DNA barcoding uncovers hidden diversity in the Snake catfish, *Clarias theodorae* Weber, 1897 (Siluriformes: Clariidae)

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The use of integrative taxonomic approaches has greatly advanced taxonomic resolution for several freshwater fishes in southern Africa, particularly for species with high levels of morphological conservatism. Results from ongoing studies indicate the diversity of catfishes in our region has not been fully documented. The genus *Clarias* Scopoli, 1777, currently contains 32 valid species distributed across the African continent. In southern Africa, there are currently only six recognised clariid species. The geographic distribution patterns of these catfishes are however complex, as some species have restricted or disjunct distributions, whereas others are widely distributed. *Clarias theodorae* in particular is divided into five isolated populations. Considering the disjunct distribution of this species, this study compared the DNA barcodes of the topotypes of *C. theodorae* with those from the other populations encompassing the species' distribution range to test the hypothesis that the current taxonomy conceals the diversity of snake catfishes in southern Africa. The study identified four distinct and geographically isolated clades: KwaZulu-Natal (KZN), Waterberg, Bangweulu-Mweru and Okavango-Zambezi. Species delimitation methods identified at least two molecular operational taxonomic units or candidate species. Despite the relatively shallow genetic divergence (1.6–2.5%), preliminary morphological examination has identified consistent diagnostic characters that distinguish the KZN lineage from the Waterberg lineage, indicating that the latter represents a distinct species that is currently being described. The restricted distributions of these two candidate species make them highly vulnerable, particularly in KZN due to the spread of invasive piscivores, *Micropterus* spp., as well as degradation of habitat and water quality.

Poster presentations

*Note: Poster # 17 withdrawn

P1

The use of ultrasonography and non-lethal biopsy techniques for histological assessment of the liver of *Clarias gariepinus*

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Freshwater pollution is one of the major issues in South Africa. Roodeplaat Dam (RD) located north-east of Pretoria, is one of the highly polluted impoundments affected by anthropogenic impacts. The health of fish inhabiting the system is adversely affected by pollution. Results from previous studies reported various histological alterations in the liver of *Clarias gariepinus* (Burchell, 1822) from this dam using lethal techniques. Previous results from non-lethal studies performed on fish reported success in accurately identifying pathology on the target species. The current study aimed to assess the efficacy of using image-guided non-lethal needle aspiration biopsy for histological assessment of the liver of *C. gariepinus*. A total of 30 *C. gariepinus* were sampled from RD and an image-guided non-lethal needle biopsy was performed using an ultrasound machine. Following the biopsy, 50% of the fish were placed in cages, returned to the system, and monitored to assess any complications that may arise from the biopsy procedure. Standard terminal sampling was done on all 30 fish to collect liver tissue for comparison with biopsied tissue. Liver samples from both techniques were processed using standard protocol for Haematoxylin and Eosin for qualitative light microscopy assessment. Adequate tissue samples were obtained for microscopy assessment using this technique. No adverse reactions were observed in the biopsied fish. Therefore, this technique was successful for histological analyses.

P2

The occurrence and potential environmental risk of organic chemicals and metals in the uMdloti and uMlalazi estuaries

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Coastal environments are the ultimate recipients of contaminants received from upstream through storm water runoff and effluent discharge. Assessing water and sediment contamination is essential to provide a measure of the medium quality conditions. In this study, water and sediment samples collected in the anthropogenically impacted uMdloti catchment and minimally impacted uMlalazi catchment were screened and quantified of organic chemicals pharmaceuticals, current use pesticides, polycyclic aromatic hydrocarbons (PAHs), and metals. Ecological risk assessment to determine whether these contaminants were cause for concern was accomplished using Predicted No-Effect Concentrations (PNECs) and sediment quality guidelines (SQGs). Pharmaceuticals were only found in water in uMdloti with some showing moderate to high environmental risk. Pesticides in water were frequently found in uMdloti than in Mlalazi and showed insignificant to very high environmental risk. PAHs and metals were predominant over pesticides in sediment in uMdloti where there is high urban and industrial influence. Metals were predominant, with three pesticides and one biogenic PAH compound exceeding limit of reporting in the uMlalazi sediment. In the uMlalazi catchment agricultural activities are the obvious anthropogenic source of contaminants hence, the minimal contamination. In the water and sediment in uMdloti catchment there were pharmaceuticals and pesticides exceeding the PNECs and, enriched metal concentrations and PAH concentrations exceeding the Effects Range Low guideline which was a cause for concern prompting need for further water and sediment quality assessment.

P3

Metal effect in energy reserves and neurotoxicity in sesarmid crabs *Cristarma eulimene* and *Neosarmatium africanum* of uMhlathuze Estuary

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Estuarine contamination by metals is of increasing concern, yet very few systems are receiving research attention, in particular estuarine systems in northern KwaZulu-Natal. In the present study samples of water, sediment, crabs were collected from two sites in uMhlathuze Estuary to investigate the accumulation of metals, their effects on energy reserves and neurotoxicity using biomarkers. Metals such as Ag, Al, Cd, Cu, Co, Cr, Fe, Mn, Ni, Pb, and Zn were recovered from water, sediment, and crab tissues such as the carapace (C), digestive glands (C), pincers (P) and gills (G) of *Cristarma eulimene* and *Neosarmatium africanum*. Minimal enrichment (1-2) was observed for Al, Fe and Mn in both sites. However, very high or extreme enrichment (20-40/>40) for Ag, Co, Cd, Cu, Ni, Pb and Zn was observed. Metal concentrations measured in water and sediment samples were higher than the South African marine water quality and the Australian TER sediment guidelines, respectively. Metal distribution in crab tissues differed between *C. eulimene* and *N. africanum* with concentrations respectively decreasing from C>P>G>DG and DG>C>P>G. Bioconcentration factors for all metals (except Al, Fe and Mn) were >1.0, signifying active bioaccumulation in both crabs. Lipids and carbohydrates were higher in digestive glands compared to gills, whereas proteins were recorded in higher levels in gills than in digestive glands in both species. Levels of AChE activity were reduced in the gills of *N. africanum* compared to *C. eulimene*. This study provides evidence of metal contamination and bioaccumulation in environmental matrices/organism in uMhlathuze Estuary.

P4

Phytoplankton and aquatic invertebrates' succession from temporary wetlands of the Maloti Drakensberg Mountains, a case study of the Sehlabathebe National Park, Lesotho

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The Maloti-Drakensberg region is renowned for its stunning mountain landscapes and rich biodiversity. Characterized by its elevated altitude and seasonal precipitation patterns, this area fosters distinctive ecosystems teeming with diverse flora and fauna and supports high levels of species endemism. Within the Maloti-Drakensberg temporary wetlands are numerous and are unique systems as they are periodically filled by summer rainfall and dry out in the winter months. This facilitates a habitat that requires organisms to have unique eco-physiological adaptations such as quick generation times or the ability to survive desiccation. Aquatic invertebrates and phytoplankton are amongst the important groups found in these systems and play essential roles in nutrient cycling, food webs, and serve as key indicators of ecosystem health and climate change. Many studies have looked at the fauna and flora of the Maloti-Drakensberg however aquatic invertebrates and phytoplankton have not been well studied. Thus, this study aims to investigate aquatic invertebrates and phytoplankton diversity, succession, and composition along the hydroperiod in thirty temporary wetlands of Sehlabathebe National Park (SNP), Lesotho. This will be the first study to look at phytoplankton and aquatic invertebrate species list, succession, and community composition in SNP. As expected, we hypothesis that there will be a shift in diversity and community composition for both phytoplankton and aquatic invertebrates with hydroperiod and that rock pools, rock tarns and Afromontane tarns will show different diversity indices and communities. This research will initiate a baseline biodiversity inventory and facilitate future monitoring efforts to inform conservation strategies necessary to safeguard these unique ecosystems in the mist of global change.

P5

Microplastic debris from temporary wetlands of the Maloti-Drakensberg Mountain: Source, distribution and ecological impacts

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Microplastics (MPs), defined as plastic particles of ≤ 5mm in size, have become a growing environmental concern globally. Exposure of these particles to the environment pose a great threat on the ecological integrity of both terrestrial and aquatic ecosystems. In cases where MPs has accumulated in habitats such as wetlands, aquatic invertebrates are prone to mistaken them for food and upon ingesting these particles, their physiological activities become disturbed. Most studies on MPs have focused on marine and freshwater systems in urban and rural settings, and we know less about MPs from remote and fragmented high-altitude wetlands in Africa. Thus, the current study will be the first of its kind to assess MPs from temporary wetlands of the Maloti-Drakensberg Mountain range. This current research aims to fill the gap on the source, distribution and ecological impacts of MPs in such environments. Water and sediments samples were collected from Sehlabathebe National Park rock pools, Afromontane tarns and rock tarns and dams in Lesotho. Although in low densities, our preliminary results shows that high altitude temporary wetlands do contain microplastic debris of varying sizes,1000-100 µm. White fragments where the most dominate debris followed by transparent, yellow and green. Fourier-transform infrared spectroscopy will be used to further identify the composition of MPs present. We hypothesise that the source of microplastic debris found in this study could be from atmospheric deposition since the area is free from human activities. Thus, we recommend an atmospheric deposition experiment to be conducted in order to get evidence and insights on microplastic sources. This study will provide empirical evidence on MPs sources and distribution from highland environments, and thus assist in this emerging contaminate management and conservation of aquatic biodiversity.

P6

Preparation and presentation of geographical data for updating the 2014 Present Ecological State - Ecological Importance and Sensitivity desktop study

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Eco-classification is the basis for setting flow and water quality ecological reserves. The process comprises the determination of the Present Ecological State (PES) and the Ecological Importance and Sensitivity (EIS) of individual river-reaches. The PES and EIS together support the recommendation of a practically attainable ecological category for each reach. The poster outlines the technical aspects of preparing certain geographical datasets, using programming in R and visualisation in Google Earth, for assisting local area experts in assigning PES and EIS classes to individual river reaches. The visualisation component is prepared in Keyhole Markup Language (KML), which is an eXtensible Markup Language (XML) for encoding data in a standard format for presentation in Google Earth. KML includes basic geographical data constructs such as points, lines, polygons and rasters. Labels in KML range from symbols and text to advanced popup balloons that can display tables and images, and web links to further information. The types of information in this project include sewage works outfalls, river geomorphological classes, subquaternary drainage regions, and landcover rasters trimmed to buffer zones around rivers. Local ecological experts need to classify more than 9000 river reaches, so the datasets for reaches are grouped into smaller clusters to stay within the computer memory limits of Google Earth. Development of the datasets and index files is a repetitive process, which means that a scripting language like R is essential for encoding the procedures used and recording the steps followed for the information of future users.

P7

Age and growth of the invasive bluegill *Lepomis macrochirus* (Rafinesque, 1810) from the Howison's Poort Dam Eastern Cape, South Africa

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Fundamental studies on the age and growth of species in their invasive range are central to understanding the biology and ecology of biological invasions. Environmental conditions of the new habitat can alter the growth and survival of the introduced species, and even facilitate adaptations not observed in their native range. Accurate and precise determination of fish age is fundamental for determining the growth rates, maturity and mortality of fishes. The present study assessed the age and growth of bluegill, *Lepomis macrochirus* from Howison's Poort Dam, Eastern Cape. Precision of readers and structures (burnt and unburnt) of otoliths were estimated, and the aging error was determined by the coefficient of variation (CV, %) and average percentage error (APE, %). The lowest APE (18.73%) and CV (17.28%) were determined for burnt otoliths. Growth zone counts on sectioned astericus showed that *L. macrochirus* attained a maximum age of 6 years. Growth for male *L. macrochirus* was best described by the von Bertalanffy Growth Model of the form $Lt = 201.2\ (1\text{-}e^{-0.312(t+\ 0.61)})$ and $Lt = 223.4\ (1\text{-}e^{-0.222(t+\ 1.21)})$ for females. A comparison of growth parameters from this study with those from its native range suggests that the species can live for a maximum of 12 years. Though the species did not attain the same age as with their native range, early reproduction (four years) could have contributed to its establishment success.

P8

Identification and occurrence of microplastics in sediments; Algoa Bay and Cape St. Francois Bay

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The pervasive nature of microplastic pollution in marine environment and the potential ecological consequences makes it imperative for monitoring. Research is needed to understand the sources, transport, and potential impacts of microplastics in marine ecosystems, as well as to develop strategies for mitigating their presence. The objective of this study was to investigate the presence and distribution of microplastics in marine sediments in Algoa Bay and Cape St. Francois Bay. Sediment samples were collected at various depths, ranging from 10 – 30 m. The samples were processed using the density separation method, analysed using microscopy and spectroscopy techniques. The analysis was done to identify and quantify the microplastics present. The results revealed the widespread presence of microplastics in the sediments of both bays, with higher levels in Algoa Bay. The presence of fibers and yellow-coloured microplastics, particularly in the size range of 1 – 2 mm, has been mostly observed in this study. Polymer type confirmed on the microplastics includes polyamide, polystyrene, and polypropylene. According to the current study results, microplastics had a higher occurrence and distribution in Algoa Bay compared to Cape St. Francis Bay. These findings contribute to our understanding of the distribution and characteristics of microplastics in the environment. Also, suggest that microplastic pollution is prevalent in these marine environments and highlight the need for further research to understand the sources, fate, and potential ecological impacts of microplastics in coastal sediment ecosystems.

P9

Spatial and temporal distribution of metals in the Salt River catchment, Cape Town

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The Liesbeek and Black Rivers are two major urban tributaries of the Salt River. The latter enters the ocean at Paarden Island, Table Bay. A multitude of pollution sources are found along the banks of these rivers, including industries, houses, sewage treatment plants, golf courses and informal settlements. The catchment has been severely modified and canalized, increasing flooding events and sediment loads downstream. This catchment is seen as potentially in the worst ecological condition of all Cape Town catchments and its condition is seemingly deteriorating consistently. However, the current degree of pollution is unknown for this catchment. This study investigates the spatial distribution of metals as well as temporal distribution, through comparison of new data with previous data from 2006, and comparison of wet and dry seasons. Sediment samples were acid digested and a range of metals were analysed with an ICP-MS. Preliminary results show that sections of both the Liesbeek and Black Rivers are heavily polluted with metals (e.g. Al and Fe) and that metal levels have significantly increased since 2006 due to increases in land use. Metal concentrations were also generally higher during the dry season, most likely due to the slower current. The Salt Rive itself has proven difficult to study as it is entirely canalized, which indicates that potentially high loads of polluted sediment are carried straight to the lagoon. This study will form an important basis for further studies on the impacts of aquatic pollution on freshwater, coastal and marine biota.

P10

Parvodinium Carty (Peridiniales, Dinophyceae) in Africa: diversity, distribution, and new records

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Dinoflagellates, a diverse group of unicellular algae, are mostly found in marine ecosystems, but some are common in freshwater habitats. These microorganisms are characterized by a unique cell structure - they can be naked, lightly, or fully armoured. In armoured species the number, shape and arrangement of thecal plates are specific and considered reliable identification criteria at species level. Members of freshwater genus *Parvodinium* Carty are characterized by thin thecal plates, with the following patterns: apical pore, pore plate, canal plate, 4', 2a, 7'', 6c, 5s, 5''', 2''''. They have yellow-golden plastids, cingulum is wide, sub-median with the hypotheca smaller than the epitheca. In most species the sulcus penetrates into the epitheca and spreads to the antapex. Taxonomically, there are 17 accepted species and 12 accepted varieties in the genus. Seven *Parvodinium* species (eight varieties including the types) are known from the African continent. Here we report new records of two members of the genus *Parvodinium* in African freshwaters: *P. centenniale* (Playfair) Carty 2008 (first record in Botswana, previously documented in Côte d'Ivoire and Madagascar) and *P. umbonatum* (F. Stein) Carty 2008 (second record in Democratic Republic of the Congo, previously documented in Côte d'Ivoire, Sierra Leone, Sudan, and DRC). A distributional map of all known records of *Parvodinium* taxa in Africa will be provided, their distribution patterns will be discussed, and SEM illustrations of newly recorded species will be presented.

P11

Metal bioaccumulation and chlorophyll content in transplanted and naturally occurring *Ceratophyllum demersum* L. in an urban South African river

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Previous research showed that the Diep River, Milnerton, is heavily polluted with metals, particularly Zn, Fe and Al. This large freshwater system is surrounded by numerous pollution sources. The macrophyte *Ceratophyllum demersum* has previously been proposed as a possible model in South African aquatic biomonitoring studies. It is well known that metals may exert oxidative stress, in turn affecting processes such as chlorophyll biosynthesis in plants. This study compared metal bioaccumulation and chlorophyll contents in two groups of *C. demersum* in the Diep River: a naturally occurring population and a group transplanted from an unpolluted pond into the polluted river, in baskets, and exposed for 12 weeks during summer. Six plants from each group were collected fortnightly, to study toxicity over time. Zn, Fe and Al concentrations were determined in plant leaves with an ICP-MS, whilst chlorophyll *a*, *b* and total chl were determined by spectrophotometry. The transplanted group rapidly bioaccumulated metals to significantly higher concentrations ($p<0.05$) than the naturally occurring plants. Chlorophyll production in the transplanted group was initially significantly promoted ($p<0.05$), probably due to the additional nutrients in the polluted water, increased sunlight in summer and protective function of phytohormones and phytochelators. The results demonstrated the species' ability to acclimatize and tolerate metal-induced stress. This study confirms the usefulness of this species as phytoremediator in South African urban rivers, where aquatic ecosystem and human health are of great concern. The reliability of chlorophyll contents as biomarker of metal exposure needs further investigation.

P12

Paleolimnological history of trace metals and persistent organic pollutants of Maputaland Lakes

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Maputaland, in northern KwaZulu-Natal, is one of the most wetland region of South Africa and consists of ecologically important systems which provide important water resources to the local communities, tourism and agricultural sites. However, most of these water resources have been reported to be contaminated with organochlorine pesticides and metals. Contamination of water systems with these chemicals adversely affects the aquatic life and human health *via* the food-chain. Although several contamination studies have been reported in the region, there is limited research on historical records of persistent organic pollutants and metals dating from 150 years ago. Therefore, the aim of the current study is to assess the historical occurrence and concentrations of metals and persistent organic pollutants of Maputaland lakes in the last 150 years using cross-correlated sediment cores. Additionally, the concentrations of these pollutants will be determined in surface water samples. The sediment samples will be cross correlated against the ^{210}Pb dated sediments to achieve the sedimentation rates. Several techniques such as inductively coupled plasma optical-emission spectrometry, inductively coupled plasma-mass spectrometry (ICP-MS), gas chromatography-mass spectrometry (GC-MS) and ion chromatography (IC), will be employed to obtain the concentrations of the analytes. The mean concentrations of the major cations in surface water samples are in the order: Na> Ca> Mg> K.

P13

Evaluation of groundwater and spring water quality in selected Villages from Nyandeni, King Sabatha Dalindyebo, Umhlontlo, and Ntabankulu Eastern Cape Local Municipalities

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Groundwater and spring water are essential resources for domestic water suppliers in many areas, specifically in rural communities. A rapid increase in contaminated groundwater with several pollutants including metals, pesticides, phenolic compounds, and microbial pathogens brings health hazards to humans. Their occurrence in water systems caused serious environmental water quality degradation, thus compromising animal, aquatic life, and human health. The assessment of their quality is fundamental to ensure healthy, clean, and safe drinking water. Therefore, the purpose of the study is to evaluate the trend and variation of physical, chemical, and microbial determinants in groundwater and spring water of selected Eastern Cape municipalities (Nyandeni, King Sabatha Dalindyebo, Mhlontlo, and Ntabankulu). The study will be carried out seasonally. Compliance of water samples will be achieved using the South African National Standard (SANS) 241:2015, Department of Water Affairs and Forestry (DWAF), and World Health Organisation (WHO). Major and trace element concentrations such as potassium, sodium, calcium, magnesium, iron, zinc, cadmium, chromium, lead, antimony, copper, manganese, and arsenic will be analyzed by ICP-OES. Pesticides and phenolic compounds including atrazine, carbaryl, carbofuran, and simazine; 2-nitrophenol, 2-chlorophenol, 4-chlorophenol, 4-chloro-3-methylphenol, and 4-nitrophenol will be preconcentrated using various solid-phase sorbents (ENV-18, LC-SCX, and HLB) and determined using HPLC-DAD. A mathematical tool namely, the water quality index (WQI) will be used to rate each water sample whether is suitable for drinking purposes or not. The machine learning that has been previously reported as the best solution for water pollution control will be used to predict changes and classification in the water quality after instrument analysis.

P14

The fish diversity of the Vaal River within the Vredefort Dome UNESCO World Heritage site

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Freshwater ecosystems are confronted with significant threats, rendering them among the most threatened globally and exhibiting a greater decline in biodiversity compared to terrestrial ecosystems. The Vaal River hosts diverse fish species due to its abundant habitat, but it is threatened by numerous anthropogenic activities. The absence of recent and comprehensive fish records in the Vaal River from the Vredefort Dome UNESCO World Heritage Site poses a problem as it hinders understanding of the fish diversity and potential ecosystem impacts. Therefore, the aim of this study was to determine the present fish community for the Vredefort Dome using traditional and newer environmental DNA methods. Field sampling took place during March and April 2023 across four sites within the Vredefort Dome. Sites were sampled using traditional methods, such as electrofishing, seine, fyke, and cast nets, as well as environmental DNA (eDNA). The eDNA samples were obtained by creating a composite water sample that was filtered, DNA extracted, then amplified with fish primers, sequenced on an Illumina MiSeq, and compared to GenBank 12S sequences for identification. The field sampling yielded 14 species with 356 individuals. The dominant taxa varied across sampled sites, but included dominant taxa were Labeobarbus *aeneus, Clarias gariepinus*, and *Labeo capensis*. Out of the 14 species identified, three were invasive: *Ctenopharyngodon idella, Cyprinus carpio*, and *Gambusia affinis*. Furthermore, *Oreochromis mossambicus* has been identified within the study area, indicating translocation from its natural distribution in Southern Africa.

P15

Exposure extent and characteristics of microplastics in selected sites along Vaal River and its tributaries

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High plastic production and consumption contribute significant amounts of plastic pollution into the aquatic environment, where they undergo further degradation, producing microplastics (MPs) (<5 mm). As emerging contaminants of concern, MPs have raised concerns as they pose potential harm to environmental and human health. The risks of MPs are poorly understood and established in the African freshwater systems. To better understand the MPs pollution in South African aquatic systems, the current study investigated the exposure extent of MPs along the Vaal River and its tributaries. The study investigated the MPs from six points located at tributaries, upstream, confluence and downstream of the Vaal River. MPs were extracted and visualised using a digital compound microscope, and images processed using Image J software. MPs were observed in all sampling sites; a size range of >1 to <5 µm was most abundant and quantified within 330 particles/L to 1336 particles/L. The tributaries were most polluted compared to the confluence and downstream. MPs were detected mostly in spherical, followed by fragments, then fibre shapes. In terms of colour, microplastics were detected in a variety of colours. Dark green and brown colours represented the dominant colours observed across all sites. The study evidenced the increasing MP's pollution along the Vaal River basin and recommend further studies to investigate the impact of this pollution on environmental and human health considering climate change influence.

P16

Synthesis and characterization of novel rGO-CS composite for the electrochemical detection of the antiretroviral drug lamivudine

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The use of antiretroviral drugs (ARVDs) such as lamivudine in South Africa is high due to the high prevalence of HIV/AIDs. The presence and wide occurrence of lamivudine in water bodies is associated with an increase in consumption and disposal of these drugs. ARVDs have been monitored and detected in aqueous matrices using HPLC, UPLC, and GC; however, these techniques are costly and time-consuming. Therefore, an alternative rapid, accurate, simple, and in-situ measurement technique is needed for the detection and quantification of ARVDs in the environment. Electrochemical sensing is considered a cheaper and simpler technique for detecting and quantifying pharmaceuticals in the environment. In this work, a reduced graphene oxide/chitosan (rGO/CS) composite was synthesized by a simple reflux method to be used as an electrode modifier to detect the ARVD lamivudine in aqueous systems. The composite was characterized using FTIR, SEM, UV-VIS, XRD, and Raman spectroscopy to investigate its physiochemical and optical-spectrometric properties. FTIR showed the presence of O-H, N-H, C=C, C-N, and C-O functional groups in the composite. SEM revealed that the composite shows smooth edges with many corrugations, while TEM revealed a mixture of smooth and rough surfaces. The addition of CS to rGO shifts the 2θ of CS from 19.91° to 22.66° , implying distortion in the crystalline structure of the compositing CS while maintaining the diffraction pattern of rGO due to excess non-binding rGO. The rGO/CS composite was used as a potential electrode modifier by drop casting on GCE and tested for the detection of lamivudine in wastewater.

P18

Assessment of the estuarine health of the Richards Bay Harbour and Mhlathuze Estuary (KZN) using the Estuarine Fish Community Index (EFCI)

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During the 1970s the Richards Bay Estuary was divided into, the Richards Bay Harbour, a large deepwater port and the Mhlathuze Estuary, a sanctuary dedicated to conserving a portion of the original system. Since then both estuaries have been identified as of conservation importance in terms of fish biodiversity in Soutth Africa. During 2016-2018, fish were sampled seasonally over two years, this data was used to calculate the estuarine health scores per season, using the Estuarine Fish Community Index (EFCI) and then averaged for a final score. Both systems were found to be in a moderate state (40-44), with the sanctuary (44±5,8) slightly higher than the harbour (42±4,0). The index also provided insight into the state of the fish community, showing that species diversity was high, but species abundances were low. Both systems score low for "Species composition (relative to reference assemblage)", "Relative abundance of estuarine-dependent marine taxa" and "Relative abundance of piscivorous taxa", the later likely due to the use of seine nets for sampling. The harbour also scored low on "Number of estuarine-dependent marine taxa" and "Number of species that make up 90% of the abundance". As such both systems were dominated by three estuarine *Ambassis* spp. accounting for 71.7% of the catch in the harbour and 51.8% in the sanctuary. The dominance of *Ambassis* spp. indicate the extent to which the estuarine functioning of these systems has deteriorated. Management and conservation are therefore of national importance for continued utilisation of these estuaries by marine fish species for completion of the life cycles.

P19

Changes in latitudes, changes in attitudes: Examining *Gnathia jimmybuffetti* from the Floridian ecoregion

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Gnathia jimmybuffetti sp. nov. is described from the Florida Keys. Morphological characterization of the male, female, and juvenile as well as the life cycle development of the female is examined. The male of this new species is distinguished from other species from the Tropical Northwestern Atlantic marine province by the slightly produced frontal margin; absent mediofrontal process; single, strong, conical superior frontolateral process, with 2 pairs of long simple setae; and rounded inferior frontolateral process, the weak distally curved mandible with weakly convex dentate blade. In addition, molecular characterization for three life stages, (males, females, and praniza), is provided, as well as evidence for linking host DNA to juvenile stages. This paper contributes to our understanding of the gnathiid biodiversity of the Tropical Atlantic realm, specifically the Floridian ecoregion. Furthermore, this paper validates the methods of extracting and identifying host DNA from the gnathiid blood meal.

P20

Human health effects associated with the consumption of two seabream species from the South African south coast

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Non-essential elements such as arsenic, lead, and mercury, are persistent, toxic pollutants with the ability to enter the food web. These elements increase in aquatic organisms through bioaccumulation and pose risks to human health when consumed, emphasizing the need for attention and regulation to safeguard human well-being. *Cheimerius nufar* and *Pterogymnus laniarius* are two seabream species that are frequently consumed by subsistence anglers. However, the risk to human health due to the consumption of element contaminated fish has not been assessed. Muscle samples of each species were collected from the research site in Mossel Bay, and element concentrations were analysed using ICP-MS, GF-AAS and FIMS. Risk of consuming element-contaminated fish were calculated using standard USEPA human risk assessment methodologies. While certain elements, such as As, Cd, Cu, Hg, Ni, Pb, Sb, and Zn, exhibited consistently higher concentrations in *P. laniarius*, exceptions were observed in the case of Cr, Fe, and Mn in *C. nufar*. It was found that the consumption of both species posed non-carcinogenic human health risks related to the concentrations of As and Hg. It was also found in the results of this research project that the consumption of both species posed carcinogenic human health risks related to the concentrations of As, Cr, and Ni. This research underscores the importance of a comprehensive understanding of element pollutants, encompassing sources, pathways, and bioaccumulation, and advocates for improved monitoring and management strategies in the aquatic environment.

P21

Gonadotropin-releasing hormone and liver vitellogenin levels in male *Oreochromis mossambicus* after exposure to antiretroviral-antibiotics mixture

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An increased frequency of endocrine activity has been observed in fish from South African rivers. It has been attributed to known endocrine disrupting compounds (EDCs) such as pesticides and other oestrogenic compounds. As different types of pharmaceuticals are being reported in aquatic environments around the country, there is concern that some of these compounds or their mixtures may contribute to endocrine activity in South African waters. Various biomarkers have been used to investigate endocrine activity in fish exposed to xenobiotics, including vitellogenin (VTG) induction in male fish liver and changes in gonadotropin-releasing hormone (GnRH) levels in blood plasma. This pilot study aimed to investigate the effects of chronic exposure to a mixture of antiretroviral drugs (ARVs) and antibiotics (at environmentally relevant concentrations) on blood GnRH and liver VTG levels of Southern African indigenous fishes. Adult male *O. mossambicus* were exposed to a mixture of efavirenz (2.45 µg/L), sulfamethoxazole (3.68 µg/L), and trimethoprim (0,87 µg/L) for 21 days in a flow-through system. At the end of the exposure, blood plasma GnRH and liver vitellogenin levels were analysed using enzyme-linked immunosorbent assay (ELISA) tests (CUSABIO®). The results showed no significant change in liver VTG and blood plasma GnRH levels between the exposed fish and the control group. These findings suggest that exposure to efavirenz and its mixture with sulfamethoxazole and trimethoprim at their current levels in South African aquatic environments does not affect VTG and GnRH in fish. However, more investigations are needed to confirm these preliminary findings.

P22

Microplastic pollution and risk assessment in sediment and *Chironomus* spp. of the Jukskei River, South Africa: A case study

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Rapid urbanisation and industrialisation coupled with population growth results in many environmental pressures. Plastics, have seen rapid production and consumption rates due to their versatile characteristics that result in their inexhaustible applications in various sectors. However, mismanagement coupled with resistance to degradation has resulted in microplastic pollution of aerial, terrestrial, and aquatic pathways. Microplastics, synthetic polymers with a length of 0.05-5 mm, are globally recognised as an emerging contaminant and are rapidly gaining research priority. This study aimed to investigate the abundance of microplastics and risks associated with them in the Jukskei River, South Africa. Microplastics were collected from water, sediment, and macroinvertebrates (*Chironomus* spp.), during the low flow (LF) and high flow (HF) seasons along the Jukskei River. Thirteen sites were selected according to location and accessibility to the river. For both seasons, sampling took place over two days. Microplastics were prevalent in all the matrices assessed. There were significant differences ($p < 0.05$) in the seasonal abundance of microplastics in the sediment and *Chironomus* spp. larvae. The sediment of the Jukskei River showed the catchment to be in a polluted state for both seasons with the pollution and polymer index indicating a low risk associated with the polymers ingested by the *Chironomus* spp. larvae.

P23

Aspects of the ecology of leeches from the Westdenespruit in South Africa title of the abstract

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Freshwater leeches are benthic invertebrates whose population assemblages depend on the abundance of food, depth, and water quality. Leeches may function as suitable bio-indicators of water pollution in South Africa as it has been used as such in Poland. This study aims to determine if leeches (*Helobdella stagnalis*) preferred specific water quality parameters and determine if the leeches had a preferred depth in four urban impoundments in Gauteng, South Africa. The study sites are found in the Westdenespruit and the Montgomery spruit. Ten sets of two sampling units (green and white boards) were lowered 5 m apart into the water at specific points along a transect in situ and left for 20 minutes. The number of leeches on each unit were then counted. The process was repeated three times on three different days for comparison purposes. The abundance, prevalence, and mean intensity were calculated and compared to unit depth, and depth profiles were generated for the length of the transects. Total dissolved oxygen, light intensity, temperature (surface and bottom), salinity, and pH were measured using a Eutech Elite water quality meter and statistically analysed. The results indicated that leeches do not have a preference for depth, but water quality plays a role in prevalence and abundance.

P24

Assessing the impact of invasive alien species on aquatic macroinvertebrates in South Africa: A systematic review

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Invasive species pose a significant threat to biodiversity, particularly in freshwater ecosystems, where species invasion, habitat loss, overharvesting, and pollution contribute to the decline of aquatic life. Among these threats, invasive alien species (AIPs) rank as a major risk to global biodiversity. AIPs can profoundly alter the physico-chemical environment of invaded areas, reshaping water chemistry and disrupting native plant and macroinvertebrate communities. This systematic review assessed scientific evidence on the interactions between invasive species and macroinvertebrates in South Africa from 2006 to 2022. Our analysis, based on eight research articles, reveals a notable concentration of studies in the Cape Floral Region, particularly in the Eastern and Western Cape provinces. Rivers emerged as the primary focus, followed by dams, with *Eichhornia crassipes* identified as the most studied invasive plant species. Our findings underscore the detrimental impact of AIPs, particularly *E. crassipes* and *Pistia stratiotes*, on the abundance of various macroinvertebrate taxa. However, certain species, such as *Psidium guajava* and *Lantana camara*, exhibited positive effects on specific macroinvertebrate families. Despite limited studies, it is evident that AIPs exert a negative influence on the abundance, richness, and assemblage of aquatic macroinvertebrates. This review highlights the urgent need for further research to evaluate the impact of invasive species on imperilled aquatic macroinvertebrate species. Addressing this knowledge gap is essential for reducing uncertainty surrounding the threat of invasive species and informing effective conservation strategies.

P25

Evaluating the hazard potential of high-density polyethylene (HDPE) microparticles using the protozoan *Tetrahymena thermophila*

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The occurrence of microscopic plastic debris in aquatic matrices is still increasing. In the environment larger pieces of plastics degrade to emerging pollutants, micro- and nanoplastic particles with specific properties. HDPE is a robust and durable plastic that is most commonly used for food packaging. However, recent studies point to environmental concerns, including effects on the development and behaviour of organisms and leaching effects from HDPE bags. One of the aquatic organisms suitable for testing the effects of xenobiotics as well particles is protozoan *Tetrahymena thermophila*, which possess features of both single eukaryotic cell and whole organism. The aim of our study was to assess the hazards of HDPE microparticles (MPs) to *T. thermophila* by applying a series of assays which are classically used for non-motile in vitro cell cultures. For particulate control two nanomaterials with known effects were tested (TiO_2 and Ag nanoparticles). All materials were extensively characterised in experimental medium. *T. thermophila* was exposed to the test particles for 24 hours according to ISO standard (4988:2022). Particle uptake in food vacuoles as well the adsorption of tested materials on the body surface were investigated. Cell viability was measured using propidium iodide/Hoechst differential staining assay. Metabolic activity was measured with resazurin, ATP and MTT assays. Cell proliferation was measured using CyQuant™ and BrdU Cell Proliferation assay. Although animals internalized HDPE MPs there were no evidence of cytotoxicity, as well there were no particles adsorbed on the body of exposed organisms. We concluded that tested material has low hazard potential.

P26

The efficiency of eDNA to detect aquatic diversity

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Environmental DNA (eDNA) analysis is an emerging field still containing reliability uncertainties. Despite its infancy, it has the potential to greatly inform aquatic conservation and management due to its enhanced scope for assessment and biomonitoring. The study aimed to test the efficiency of eDNA analysis in comparison to traditional methods through taxonomic data comparison. Four sampling sites from Mankweng, South Africa were identified. Water for eDNA was collected where after traditional methods were used to sample for macroinvertebrates and fish. Collected water samples were analysed at the NatureMetrics laboratory in the UK using PCR and next generation sequencing. The traditional methods included a 0.5 mm mesh net for macroinvertebrates and electrofishing, cast net and seine netting for fish. eDNA detected a higher diversity of macroinvertebrates compared to traditional sampling, with *Chironomus transvaalensis* being the dominant species for both methods. eDNA results presented three fish species from three families as well as the the African clawed frog, where two of these fish species were collected using traditional methods. The results suggest eDNA to be more effective in bioassessment compared to traditional methods and can supplement intensive and time consuming traditional methods. The eDNA analysis method should be promoted to become a routine tool for future biomonitoring and bioassessment due to its reduced impact and ethical convenience.

P27

Parasite diversity as bio-indicators of aquatic ecosystem health: *Chetia flaviventris* Trewavas, 1961 from four impoundments as a case study

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Generally diverse parasite assemblages can be found in host populations from healthy aquatic ecosystems. Various factors can influence the distribution and abundance of parasites, and as a result, the presence/absence of parasites can provide important information on the health of individual host organisms and their populations. Many parasites have complex life cycles, requiring several hosts, often in different environments. The success of the parasite is therefore correlated with the sum of suitable habitats and hosts throughout its life cycle. Pollution and other environmental stressors can compromise these suitable habitats and hosts, and given the association between parasites and their environments, parasites can be regarded as indicators of environmental quality. The study focused on evaluating the diversity of metazoan parasites infecting *Chetia flaviventris* Trewavas, 1961 from four impoundments. The diversity of parasites were higher at Doorndraai Dam and Rust de Winter Dam (Limpopo Province) which were less impacted compared to Roodeplaat Dam (Gauteng Province) and Hartbeespoort Dam (North West Province) which represented more impacted localities (with no ectoparasites recorded at the latter two localities). Parasites were represented by six different groups of metazoan parasites comprising ectoparasites (Monopisthocotyla, Branchiura and Copepoda) as well as endoparasites (Monopisthocotyla, Digenea, Cestoda and Nematoda) with several new host and locality records. Parasites are integral components of ecosystems and their occurrence, abundance and diversity reflect the underlying health of the system. This work is based on the research supported by the DSI and the NRF of South Africa (Grant Number 101054).

P28

The ecological health of the Letaba River using benthic aquatic macroinvertebrates as response indicators

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A study was conducted in November 2022 (high flow) and April 2023 (low flow), in the Letaba River (Limpopo Province) with the objective to establish the ecological health of the river at six different geographical locations by using the South African Scoring System version 5 (SASS5 monitoring) making use of benthic aquatic macroinvertebrates. The SASS5 protocol, developed by Dickens and Graham (2002) for South African rivers, was followed to evaluate the river health using benthic aquatic macroinvertebrates. The ecological categories, ecoregions and biological bands defined and developed by Dallas (2007) were used to interpret SASS data for the specific region in South Africa. SPSS statistical software version 29 was used to determine statistical differences between sites. The Letaba River is located within the Lowveld - Lower ecoregion. According to the biological bands, three sites showed fair river health, one site poor river health, one site good river health with one site categorized as natural river health. The SASS5 scores did not indicate significant differences between the sampling seasons and the sampling sites ($p>0.05$). The ASPT did not show any significant differences between sampling season and sampling sites ($p>0.05$). The overall SASS indices indicated that the water quality at most of the sites within the Letaba River could be considered as fair. Most of the sites on average fall under ecological band C, suggesting that the Letaba River water quality status may be in a moderately modified state.

P29

The development of an automated colourimetric analysis method for water quality assessment using artificial intelligence techniques

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Water quality assessment is a critical aspect of environmental monitoring, notably in recent years with the Department of Water and Sanitation's 2022 report highlighting water treatment infrastructure failures, threatening South Africa's water security. A possible solution to this is the use of colourimetric analysis to detect contaminants based on colour changes. However, traditional methods have limitations, including variability and the need for expert human interpretation, hindering its widespread use, especially in resource-limited settings. In response, an artificial intelligence – based algorithm that automates colourimetric analysis has been developed. The algorithm uses the You Only Look Once (YOLO) model for object detection to process images of a custom paper-based water test strip designed by ILabs. The parameters tested by the strip include nutrients, total metals, and total coliforms. Computer vision is then used to identify the colours of these patches by converting RGB pixel values into qualitative data, which is cross-referenced with acceptable ranges outlined by the SANS241 guidelines for safe drinking water. The YOLO model achieved a preliminary 0.91 F1 score after 50 epochs of training, indicating a 90% accuracy rate in identifying regions of interest on the strip. The algorithm obtained a 97% colour classification accuracy rate under both ideal and non-ideal lighting conditions. The algorithm's integration into a mobile app provides users with a reliable and cost-effective tool for rapid water quality testing. Additionally, it opens doors for future applications such as early warning systems for emerging contaminants and providing actionable data to water management organisations.

P30

Aquatic community structures of temporary pans following inundation along an aridity gradient in southern Mozambique

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The ecology of rainfed, endoheic pans are reliant on annual precipitation and are adapted to fast living life histories for survival. These temporary habitats are an integral part of the freshwater environment but are not yet well documented in southern Africa in terms of ecological processes. This study takes place at the end of the annual Mozambican wet season in 2024. The community changes of five different temporary pans were documented across an aridity gradient. Different methods including a standard sweep net (mesh 1 mm x 1 mm), hand nets, sein net, and zooplankton net (mesh 64 µm) were used. All organisms were identified to the lowest taxonomic level possible. Preliminary findings indicate that the first phase of a pan after inundation following rains resulted in low pH (7.0 – 8.0) and conductivity (20 - 60 µS/cm). After inundation some of the first recruitment occurs in large Branchiopoda from the orders Anostraca and Conchostraca (new orders - Cyclestheridae, Laevicaudata, and Spinicaudata). Recruitment of fish such as *Nothobranchius furzeri* (turquoise Killifish) and *Nothobranchius orthonotus* (spotted Killifish) fingerlings only occurred last in all sampled pans after inundation. During the final stages of a drying pan predatory invertebrates (including individuals from the families Nepidae and Dyticidae) and some fish species (*Nothobranchius furzeri*, *Nothobranchius orthonotus* and *Protopterus annectens)* dominate. The water quality during the final stages of pan dry-out reached extremes with conductivities ranging between 600 – 1000 µS/cm, and pH values between 5 - 6.2.

P31

Spotlight on environmental hazards in the globally harmonized system (GHS) of classification and labelling of chemicals

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GHS provides specifications for the classifications, management and communication of hazards in the form of signal words, hazard pictograms and hazard/precautionary statements on labels and Safety Data Sheets (SDS). GHS classifies certain substances as hazardous to the environment to alert users of the hazards these substances present to ecosystems. A critical assessment of the issues and challenges around environmental hazards in GHS is necessary for optimal protection of the environment. Currently, in the environmental hazard class, substances are only classified according to their aquatic toxicity and their ability to destroy the ozone layer.This paper discusses the issues and challenges around the use of various parameters such as EC_{50}, LC_{50}, and NOEC, in fish algae and crustaceans, as well as bioaccumulation, solubility and degradability for acute and chronic aquatic toxicity. The paper also discusses the limitations imposed on GHS by the omission of terrestrial toxicity including toxicity to birds, mammals, bees, earthworms, micro-organisms and other species

P32

Detecting changes in fish behaviour in real-time to alert managers to thresholds of potential concern

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Fish behaviour is one biological organisational level regularly used to assess the state of freshwater ecosystems and can be monitored using fish telemetry methods. The development of activity sensors incorporated into fish telemetered tags allows for non-spatial movement to be detected and is increasingly used to understand the energy budgets, and response and fine-scale behaviour of fishes. In addition, detecting tagged fish remotely and in real-time highlights the need to process fish activity data in near real-time to make it relevant to managers in the water resource sector. Our study on *Labeobarbus natalensis*, a cyprinid, in the uMngeni River in KwaZulu-Natal, South Africa, adapted and then tested the exponentially weighted moving average (EWMA), as developed for financial predictive modelling, using activity data from fish. To determine changes in behaviour, we compared the EWMA predicted fish behaviour against the present fish behaviour. We showed that the EWMA could adequately detect changes in behaviour on both individual and population levels. Changes in behaviour are potentially indicative of a change in environmental conditions and thus were developed into management alerts. We conducted further analyses using generalised additive mixed models (GAMM) to determine the relationship between fish activity and the environmental data collected. The GAMMs helped determine the potential drivers for changes in behaviour where the EWMA could detect these in real-time. Detecting changes in behaviour in real-time as a result of environmental variables can identify thresholds of potential concern influencing management decisions and allow managers to respond, contributing to improving effective freshwater management.

P33

Developing best practice for fishway design when constructing bulk transfer weirs in South Africa

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Migratory fish occupy and contribute to the subsistence, recreational (socio-economic) and spiritual components of human activities associated with aquatic ecosystems. Migratory species link freshwater and marine environments and participate in the circulation of nutrients and energy. Fragmenting migratory routes will reduce a river's resilience to anthropogenic stress, including climate change, and negatively impact local communities that rely on subsistence fishing for survival. Migratory species that contribute to ecosystem services are increasingly threatened by the construction of instream barriers, and altered habitat, such as canalization and impoundments. Understanding how migratory fish move over instream barriers, either for upstream or downstream migration, is a key knowledge gap in South Africa, with presently applied fishways outdated and do not include global advances in the field of study. The uMkhomazi River in KwaZulu-Natal is one of few free-flowing rivers in South Africa, with its source near the Lesotho border past above 3000 masl. and catchment area ca. 4387 km2. To meet the growth in demands on the south coast of KwaZulu Nata, a Lower uMkhomazi Bulk Water Supply Scheme (LUBWSS) has been designed with one weir already in the construction phase. The LUBWSS will fragment the lower uMkhomazi River, significantly impacting natural aquatic habitats and species migration. To mitigate this the LUBWSS has incorporated a rock ramp and a vertical slot fishway to facilitate aquatic faunal migrations. The ecological and hydraulic efficacy of such structures are still under evaluation, yet they have been built on practices considered as ‘best practice’ in the region. The complex flow environments caused by fishways can negatively impact fish behaviour, their habitat selection, and their available energy budget to migrate upstream. Advances in fish telemetry, fluid mechanics, and acoustic-based flow measurement techniques can address some of these issues. Our study aims to merge the ecological and engineering disciplines to improve fishway design and better our understanding of migratory species and the measures in place to mitigate the impacts of instream barriers. We hope to present solutions to better regional fishway design mitigating negative impacts when using the water resources in South Africa, improving sustainability.

P34

Effects of river regulation on aquatic invertebrate community composition: a comparative analysis in two southern African rivers

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Rivers worldwide are regulated for various anthropogenic purposes, resulting in alterations in the ecology of these ecosystems. Despite their vulnerability to anthropogenic impacts, there is a scarcity of research in Africa on regulated ecosystems. This study examined the impact of river regulation on aquatic invertebrate communities on the Phongolo River, a regulated river, and the Usuthu River, an unregulated river, and their associated floodplain wetlands in the Lower Phongolo, South Africa. It further assessed whether Lake Nyamithi, a naturally saline lake receiving water from both of the aforementioned rivers, exhibited a similarity to either of the rivers in terms of its aquatic invertebrate composition. Aquatic invertebrates and water data were collected from 2012 to 2018 from the rivers and floodplain habitats. Findings revealed a diverse and sensitive aquatic invertebrate community in the Usuthu River, highlighting its conservation importance, while the Phongolo River showed signs of anthropogenic influence, with resilient taxa dominating. Lake Nyamithi exhibited a distinct aquatic invertebrate community, emphasising its unique ecological role. Mismanagement threatens sensitive species in the Phongolo River, compounded by the presence of invasive species and these findings stress the importance of water management to preserve aquatic biodiversity and sensitive species in regulated river systems.

P35

The development of a three-dimensional *ex vivo* respiratory model for nanomaterial exposure

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Due to their multifunctional biomedical and industrial applications, nanomaterials, have seen an increase in synthesis, use and waste disposal to the natural environment. The biodistribution and accumulation of nCuO particles is poorly understood in biological organisms. This study aimed to investigate the interaction, biodistribution and cellular uptake of nCuO in live excised respiratory ABO tissue of the Clarias gariepinus, compared to a developed three-dimensional model of the same tissue. ABO tissues of C. gariepinus were acutely exposed to nominal concentrations of 350 µg/L and 3.5 and spiked at 3.5 mg/L nCuO. Materials were characterized in RO water using dynamic light scattering technology. Uptake, biodistribution and agglomeration of particles were analysed using CytoViva dark field hyperspectral imaging, light microscopy and scanning electron microscopy and where possible Image J was used to quantify the number of foreign bodies found. Characterization results suggest a dose-dependent hydrodynamic size distribution and agglomeration of nanoparticles in both live and synthetic tissue. Attachment to the surface of tissue is observed in both groups however the synthetic group statistically resulted in more accumulation and agglomeration. It is hypothesised that might be due to the stability or charge of PLA in water. This study has successfully employed the ex vivo and alternate approaches, significant differences were observed, and nanomaterial toxicology testing has the potential to include alternate methods, mentioned in this study, reducing ethical considerations involved in animal studies.