



NRF-SAIAB

ANNUAL RESEARCH
REPORT 2022



National Research Foundation | South African Institute for Aquatic Biodiversity

The cover features a close-up photograph of three fish, likely Nile tilapia, swimming in clear water. The fish are positioned diagonally across the frame, with the largest one in the foreground and two smaller ones behind it. The lighting is warm, highlighting the scales and fins of the fish. The background is a soft-focus view of the water and some greenery at the bottom.

NRF-SAIAB

Annual Research Report

2022

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This report is intended to reflect progress in the research activities of the South African Institute for Aquatic Biodiversity (NRF-SAIAB). The information contained in the individual project reports may not be quoted or cited elsewhere without the permission of the authors or the Managing Director of the Institute.

Data generated by the various research projects will be published in peer-reviewed literature in due course.

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INNOVATE, DISCOVER

Promote Globally Competitive
Research & Innovation

EXPLORE

Platform Provision &
Infrastructure Development

TRANSFORM

Human Capital Development

NETWORK

Strategic Engagement & Collaboration



FOREWORD

Meeting the new challenges in the aquatic world through excellence and innovation

The South African Institute for Aquatic Biodiversity (NRF-SAIAB) is a Schedule 3A Public Entity of Government responsible for conducting research and promoting technological advance and innovation in both the freshwater and marine environments in South Africa.

The Institute serves as a hub to facilitate national and international scientific research into the country's most precious resource - water - and the diversity of life supported by our ocean, coastal and inland freshwater systems.

The NRF-SAIAB's objective is to undertake action research that responds to the global challenges while ensuring the sustainability of Africa's marine & freshwater ecosystems.

To achieve this, NRF-SAIAB provides research platforms and infrastructure that pioneer a wide range of multi-, transdisciplinary and multi-institutional research into inland fisheries and freshwater ecology, constantly changing coastal systems, the blue economy, and the movement ecology of marine animals. All the research undertaken at NRF-SAIAB contributes valuable knowledge and solutions regarding the functioning of water-based ecosystems, with emphasis on all those societal dimensions that explicitly link to water, including the impact of human activities on coastal, estuarine and freshwater resources. This information is essential for understanding and supporting appropriate management of these vital natural resources and activities within the aquatic environment, ultimately benefiting the long-term wellbeing of the people of South Africa and the Global South.

Drawing from the NRF values, mission and priorities, re-imagining research through principles of knowledge advancement, innovation, multi- and trans-disciplinarity, Open Science, Responsible Research Advancement (RRA) and institutional commitment, is what researchers, postgraduates, post-doctoral fellows and Honorary Research Associates at NRF-SAIAB aim to pursue in order to respond and adapt to the evolving curiosity and societal-driven needs and challenges in the aquatic realm. Such high calibre, broad reach, transformative, and impactful research pursued at the NRF-SAIAB is largely made possible by the NRF-SAIAB's unique research platforms available to the broader research community in the National System of Innovation (NSI). These platforms encompass: aquatic biodiversity collections; associated specialist laboratories and services which integrate modern molecular and bio-banking systems; a fleet of vehicles; a community-driven marine flagship programme (the African Coelacanth Ecosystem Programme - ACEP); marine platform provision, including coastal crafts, in situ instrumentation, a Remotely Operated Vehicle (ROV), Remote Underwater Video Systems, the Acoustic Tracking Array Platform (ATAP), the Geophysics and Mapping Platform (GeMap), and the Aquatic Ecophysiology Research Platform (AERP). During 2022, 235 individuals made use of the NRF-SAIAB platforms.

The recent and ongoing development of the Joint Marine Laboratories at strategically chosen Historically Disadvantaged Institutions (HDIs) further highlights the extended impact of NRF-SAIAB in terms of science advancement, reach, and related products in South Africa and beyond. Additionally, NRF-SAIAB hosts the DSI/NRF Research Chair in Inland Fisheries and Freshwater Ecology and it serves as a regional platform for freshwater African aquatic biodiversity research. Through collaborations and project management with various sub-Saharan countries, NRF-SAIAB plays a crucial role in advancing research in this field.

The NRF-SAIAB engages dynamically and responsively with universities, and local and national government bodies to address pressing environmental issues. These issues require the integration of evidence-based science with management, enabling NRF-SAIAB to provide scientific advice that policy makers can use to formulate national environmental policies. The NRF-SAIAB's involvement

extends to various areas of national concern, including socio-economic development, water security issues, ecosystem degradation and the influence of climate change on food security.

Team science remains a key pillar of NRF-SAIAB's research endeavour, with strong collaborations established and/or ongoing with national and international partners. Furthermore, NRF-SAIAB has signed contracts, memoranda of understanding (MoUs), and memoranda of agreement (MoAs) with multiple institutions, state and industry stakeholders, practitioners, and community organisations, delivering multi-million Rand projects and hence advancing research and supporting sustainable development initiatives.

The NRF-SAIAB fosters a healthy and productive research culture by prioritising key parameters, such as commitment to inclusion, real-world impact, and open scholarship practices. These parameters are reflected in the mentorship style embraced by NRF-SAIAB's research staff. By doing so, researchers at NRF-SAIAB passionately train postgraduates to strive for excellence and develop the ability to adapt and respond to future professional pursuits, hence preparing the next generation of scientists and practitioners. In 2022, NRF-SAIAB-supervised students were enrolled at a number of higher institutions in the Eastern Cape Province, primarily Rhodes University, North West University, and Nelson Mandela University. The group comprised 5 BSc Hons, 17 MSc and 22 PhD students. A critical focus for NRF-SAIAB is the transformation of demographics, and in this regard, 91% of students supervised by NRF-SAIAB researchers were South African, of which 58% were black and 60% were women. Notably, in 2022, several students successfully completed their studies at the MSc (14) and PhD (8) levels, with four individuals earning distinctions. The NRF-SAIAB recognises the value of providing world-class training opportunities, including being afforded opportunities to attend national and international meetings. In 2022, several students attended national conferences, such as the Southern African Marine Science Symposium and the Southern African Society of Aquatic Conference. Noticeably, current PhD candidates, Ms Nobuhle Mpanza and Dinah Mukhari, attended the 22nd International Conference on Aquatic Invasive Species (ICAIS) in Ostend, Belgium, highlighting the commitment of NRF-SAIAB to exposing its students to global research platforms.

A steady publication output by NRF-SAIAB continued in 2022, despite an anticipated impact of a Covid-related lag effect and the decreased number of research staff. A total of 105 ISI-rated scientific papers were published during this period. Additionally, there was an active participation in conferences and symposia with 73 presentations given during this year.

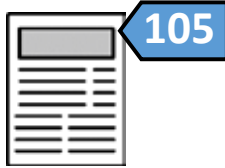
The following sections provide the research highlights of activities & achievements by the individual teams.

Prof. Francesca Porri
Senior Scientist;
NRF-SAIAB Science Leadership Team



SAIAB IN NUMBERS

Science and Society



Scientific articles



Popular articles



Public presentations



Books

Internationalisation



Conferences



Collaborations



Contracts

Local	43	40	88
Global	30	29	9

Human Capital



Employees

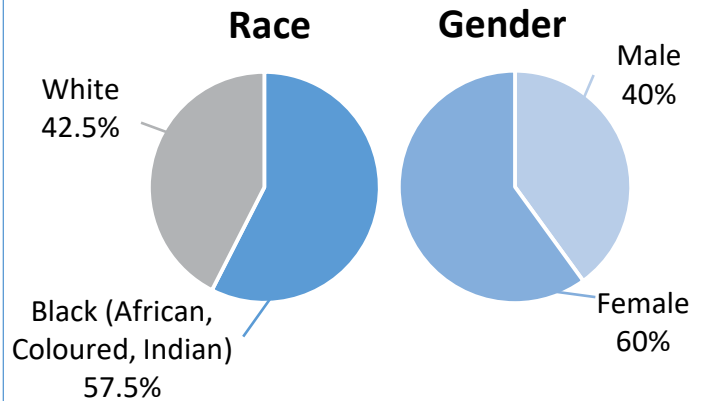


Students

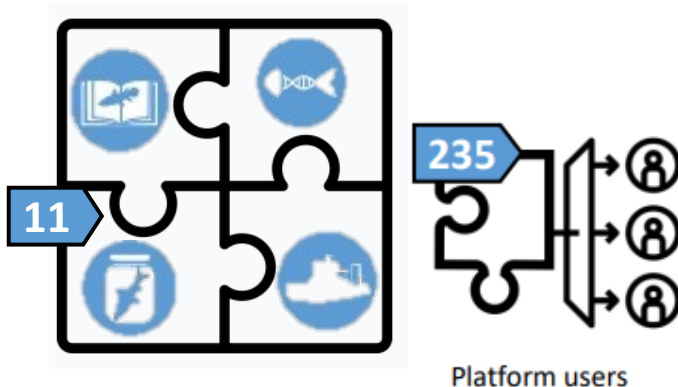


Researchers

Student demographics

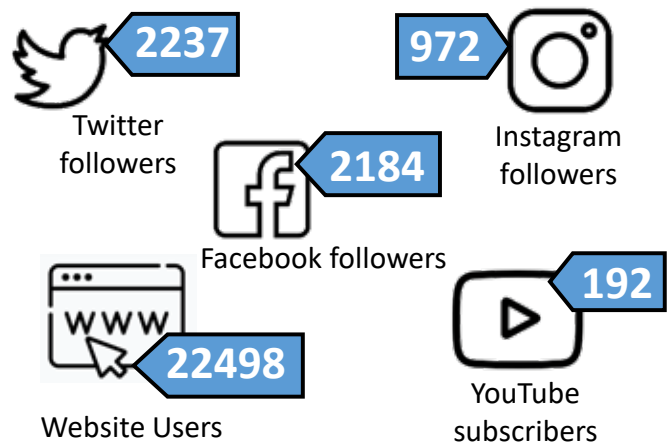


Platforms



Platform users

Social Media



INNOVATE

DISCOVER

Promote Globally Competitive
Research & Innovation



Advancing biodiscovery & species inventory: the foundation for guiding sustainable development and safeguarding critical benefits from freshwater ecosystems

DR ALBERT CHAKONA
SENIOR SCIENTIST

TEAM MEMBERS

Albert Chakona, Pedro Bragança, Roger Bills, Mandla Magoro, Lubabalo Mofu, Lizaan de Necker, Paul Skelton

STUDENTS AND INTERNS

Yonela Sithole (PhD), Tholoana Ntokoane (PhD), Martinus Scheepers (PhD), Tadiwa Mutizwa (PhD), Nenekazi Mthombeni (MSc)

COLLABORATIONS

RU, SANBI, CapeNature, Ezemvelo KZN Wildlife, MTPA, LEDET, DETEA, Gorongosa National Park, Natural History Museum of Zimbabwe, University of Zimbabwe, Lake Kariba Research Station, Lurio University, MRAC Belgium, Cornell University, ZSM - Germany, University of Basel

Freshwater is the major driver of socio-economic development in southern Africa.

Current projections, however, indicate that the demand for water in this region will continue to increase due to rapid population growth, ongoing industrial and agricultural development, coupled with the projected decrease in precipitation and increase in temperature. Excessive extraction of water has already caused unprecedented impacts on wetlands and has altered the hydrological regimes of several rivers in this region. This has negatively affected aquatic biodiversity, with cascading effects on human communities through loss of vital ecosystem services. Considering that surface water is already overallocated, the scarcity of the “blue gold” represents one of the major threats to the region’s future development. Additional pressures on freshwater ecosystems and their associated biodiversity include environmental degradation, pollution, and the spread of invasive species. In South Africa, the most recent National Biodiversity Assessment (NBA 2018) showed that freshwater taxa, specifically freshwater fishes, are far more imperiled than their terrestrial and marine counterparts. In 2022, the Freshwater Research Unit at the NRF-SAIAB, through collaboration with various national, regional and international stakeholders, continued to generate and provide information relevant for guiding implementation of science-based decisions for effective management of freshwater ecosystems and their biodiversity to contribute towards achieving various goals/targets aligned to national and international protocols such as South Africa’s NDP 2030, the African Union’s Agenda 2063, and the United Nations’ Sustainable Development Goals (SDGs).

Context and Impact

One of the major impediments to effective management of freshwater ecosystems and their associated biodiversity is the incomplete knowledge of the diversity and distribution patterns of freshwater taxa and the ecological roles that they play. There is also no clear understanding of the origins and factors that influenced present-day biogeographic patterns of this fauna.

To address this knowledge gap, in 2022 the Freshwater Research Unit at NRF-SAIAB, in collaboration with researchers from a number of institutions in South Africa, secured a large grant funded by the NRF-FBIP to initiate a three-year project, named REFRESH, to i) provide a coordinated approach to mobilise and update diversity and distribution information for seven groups of freshwater taxa; ii) undertake comprehensive field surveys to fill information gaps in poorly explored areas in the country; iii) identify long-term monitoring sites to generate data on trends and the status of the country’s freshwater biodiversity, and iv) contribute to human capacity development through training postgraduate students. This information will

impact the implementation of national policies on biodiversity conservation

enshrined in the National Environmental Management: Biodiversity Act (NEM:BA) and the Water Act, as it will feed into various evidence-based decision-making tools that are currently impeded by limited availability of freshwater data.

These tools include the South African national and global IUCN Red List assessments, the Environmental Impact Assessment Screening Tool that is being developed and updated by the Department of Forestry, Fisheries and Environment (DFFE), and updating of the National Freshwater Ecosystem Priority Areas (NFEPAs). The

research teams working on freshwater fishes, freshwater fish parasites, amphibians, crabs, dragon flies, large branchiopods and snails commenced their surveys in 2022.

The Topotypes Project is another flagship project that continues to contribute towards building a comprehensive reference library of DNA COI barcodes of specimens collected from the type localities of all freshwater fishes of southern Africa. Among the targeted species are endangered and economically important species, especially for inland small-scale fisheries. This reference library is unique in Africa, since it links all generated DNA data to voucher specimens housed at the NRF-SAIAB ichthyological collection, thus identifications can be associated with a particular individual. In addition to the COI barcodes, we have established a collaboration with Iridian Genomes to sequence Whole Genomes of types and topotypes of all valid species of freshwater fishes of southern Africa. The Topotypes Project thus has a major impact on the development of conservation policies and provides an accurate database from which relevant authorities, conservationists and researchers alike will benefit.

The first phase of the Nile Tilapia Mapping Project, initiated in 2019 to map the distribution of *Oreochromis niloticus* in the Limpopo and Mpumalanga Provinces, was completed in 2022. For the first time, the distribution of the native *O. mossambicus* and the introduced *O. niloticus* and their potential hybrids, have been accurately mapped in these provinces. A comprehensive database of georeferenced distribution records linked to voucher specimens, tissue samples for DNA analysis, and live colour photographs of the specimens deposited into the National Fish Collection at NRF-SAIAB has been generated. This resource has an environmental impact as it will contribute to guiding DFFE and regional conservation agencies with a more informed permitting process for sustainable socio-economic development through aquaculture farming while protecting the genetic integrity of the threatened native *O. mossambicus*.

Work to map the distribution of *O. niloticus* in KwaZulu-Natal Province commenced at the end of 2022 and will be finalised in 2023. A comprehensive database of Whole Genomes and microsatellites of the various populations of *O. mossambicus* is being created to build capacity for rapid detection of the genetic integrity of native *Oreochromis* species in southern Africa.

Regional and international collaborations as well as building of a critical mass of the next generation of researchers and taxonomists are central to the goal of advancing biodiscovery and providing species names. One PhD student submitted her thesis in 2022 and another three are on track to finalise their PhDs in 2023, contributing to the formation of the next generation of scientists.

Through ongoing and newly established collaborations in southern and east Africa, expeditions were carried out in Zimbabwe, Mozambique, Namibia and Kenya. A long-term collaboration has been established with Gorongosa National Park in Mozambique to undertake extensive aquatic biodiversity surveys within the park and surrounding areas.

Collaboration between African countries is being prioritised, considering the transboundary nature of many of the rivers in southern Africa.

In terms of knowledge generation and impact, the major outputs have been the publication of three comprehensive papers: an updated checklist and a synthesis of the conservation status of all freshwater fishes of South Africa; new insights on the phylogenetic relationships of two families of African catfishes; resolving the generic placement of a lineage of weakly electric fishes in southern Africa through the sequencing of the holotype of a mormyrid specimen that was collected almost two centuries ago.

Natural history collections are indispensable repositories of critical natural heritage resources and researchers at NRF-SAIAB are in the process of developing our capabilities in museomics, the ability to extract and generate molecular data from museum specimens. The year 2022 also saw a major shift with the increased capacity in generating and analysing large data within a next generation sequencing context, particularly sequencing of and analysing of whole mitochondrial genomes of target species.



Dr Albert Chakona, Dr Pedro Braganca, Prof. Paul Skelton, Dr Martine Jordaan & Dr Robert Skelton in search of the Klein Sandelia and Klein Galaxias that are both endemic to the Klein River system, Western Cape

Effective management of invasive aquatic species in South Africa

DR JOSEPHINE PEGG

**INTERIM SARCHI
CHAIRHOLDER &
POST-DOCTORAL
FELLOW**

TEAM MEMBERS

Josephine Pegg

STUDENTS AND INTERNS

Nobuhle Mpanza (MSc), Dinah Mukhari (MSc), Daniel van Blerk (MSc), Hima Rama (MSc), Casey Broom (PhD), Nawa (PhD) Mohammed Kajee (PhD)

COLLABORATIONS

RU, NMU, SU, WITS, CapeNature, SANParksGermany, University of Basel

The research undertaken by the SARChI Inland Fisheries and Freshwater Ecology team has increased understanding of the role of alien fish introductions for fisheries, and subsequent ecological consequences. This information is

*essential for developing
management strategies to
limit the impact on native
biota while maximising
economic & food security
benefits.*

Under the Chair, research has been directed at better understanding alien fishes in southern African ecosystems from ecological, societal and economic perspectives, and providing this information to decision makers and managers to enact appropriate legislative and management responses. In addition, through student mentorship, there has been upskilling and human capacity building in this field.

Context and Impact

The SARChI research group has produced a significant body of work which is used to inform policy. For example, research on the impact of non-native fishes on ghost frogs in the Cape Fold Ecoregion was used by the IUCN in their recent red-listing assessment. Listed species are subject to a greater level of protection under national and international legislation, therefore the impact for the species, and more critically, the potential to improve overall catchment health as frogs are important ecological indicators (SDGs 6 and 14) may be considerable, although as yet unrealised. At a national level, the group's work has informed the recent revision of the NEM:BA invasive species regulations listings. Research on carp in Groenvlei in the Western Cape has informed management of the protected water by Cape Nature, specifically by optimising timing and methods of carp removal. This research has ensured that the limited budget available has been used to remove the maximum number of invasive carp, and the consequences of this with regard to improvements in ecosystem health are being monitored in a collaborative effort with NMU.

In 2022, the group was particularly successful with respect to providing development opportunities for graduate students to present on an international stage. Two South African women and the Interim Chair presented their research at the International Convention on Aquatic Invasive Species in Ostend, Belgium. The impact of this trip on the students has been the formation of international links with the potential to advance their careers and their increased investment in their own research careers - both have continued to further postgraduate studies.



MSc student Daniel van Blerk surveying the Outeniqua mountain streams for ghost frogs & non-native fishes.

Shallow water seascape connectivity

PROF. NICOLA JAMES
SENIOR SCIENTIST

TEAM MEMBERS

Nicola James, Taryn Murray, Anthony Bernard, Carla Edworthy, Phakama Nodo, Rebecca Welch, Amber-Robyn Childs, Gavin Rishworth, Lucienne Human, Janine Adams, Anusha Rajkaran, Shirley Parker-Nance, Paul-Pierre Steyn

STUDENTS AND INTERNS

Them bani Mkhize (PhD), Melissa Pollard (PhD), Mihle Gayiza (PhD), Kylen Brown (PhD), Christian Hempell (MSc)

COLLABORATIONS

RU, UWC, NMU, NRF-SAEON

Coastal habitats including seagrass, seaweed meadows, reefs and mangroves provide a number of important ecosystem services, such as the provision of nursery and feeding areas for fishes and other species (which underpin fisheries), filtering of sediment and contaminants, as well as climate change refugia. Habitat degradation and loss of structural complexity, however, seriously threaten coastal habitats, with impacts associated with climate change (such as habitat and species loss) placing additional pressure on these important systems. Identifying and valuing habitats within seascapes, as well as quantifying impacts are critical if these habitats are to be constructively managed and/or conserved.

The seascape ecology group at NRF-SAIAB strives to

understand multi-scale linkages between seascape structure, function, & change to better support sustainable ocean development, biodiversity protection & help to understand the consequences of human activity on ecosystem services.

Focussing on shallow nearshore and estuarine environments, the group i) maps and models seascape spatial structure through the collection of high-resolution georeferenced imagery; ii) studies the impact of climate change in seascapes (seascape change), with a focus on seagrass, seaweed and associated organisms, as well as the role that seagrass and seaweed may have in mitigating the effects of ocean acidification; and iii) assesses connectivity of mobile organisms (fish) within seascapes and between shallow nursery seascapes. By better understanding these linkages and impacts, the

group aims to contribute knowledge that can ultimately inform effective management and conservation strategies for these important coastal habitats.

Context and Impact

With the increasing demand on marine resources, there is a dire

need to determine the socio-ecological importance of the coastal region so that appropriate management & conservation measures can be prioritised.

Continued urbanisation, agriculture and the critical need for freshwater impose numerous anthropogenic pressures on the natural environment and resource health and productivity. Identifying highly productive areas (especially nursery areas) affords managers the evidence-based resources needed to target and protect or restore these areas.

In order for research to impact understanding, learning and participation, the seascape ecology group aims to align its research with international and national strategies (such as the Marine Research Plan and the UN Decade of Ocean Science for Sustainable Development) and to include various stakeholders and societal groups by disseminating knowledge and encouraging participation. This is done by generating both tangible scientific outputs (papers, book chapters and presentations) and engaging meaningfully through public and social media platforms.

In 2022, seven peer-reviewed articles, one book chapter and two policy briefing notes were published on seascape ecology and/or climate change. One of these papers was an invited review paper on the role of macroalgae as nursery areas for fish within coastal seascapes for the launch of *Cambridge Prisms: Coastal Futures*. This new, open-access journal explores all aspects of coastal systems, including complexity and change over time. Research was presented at five conferences in 2022: Ocean Sciences Meeting 2022, 17th Southern African

Marine Science Symposium, Estuarine, Coastal and Shelf Association (ECSA) 59th Conference, Western Indian Ocean Marine Science Symposium and Fifth International Symposium on the Ocean in a High CO₂ World, hence showcasing a comprehensive local, regional and global coverage.

In addition to academic contributions, the group also strives to inform and engage with stakeholders and societal groups on topics and issues related to coastal habitats and their management. A plenary talk on estuaries and climate change was presented at the National Marine and Coastal Educators Network (MCEN) conference, and research in Algoa Bay was highlighted in two talks given at NRF-SAEON's National Science Week Algoa Bay research symposium. The group also maintains social media platforms (e.g. Twitter and Instagram: @SeascapeEcolSA) and a research webpage (<https://seascapeecology.wixsite.com/seascape-ecology-res>) which aims to disseminate their research to stakeholders and society. This includes industry stakeholders, such as the linefish community, marine spatial planners, resource/environmental managers and educators who will benefit directly from the research outputs, as well as local communities and the general public. These means of engagement aim to develop societal awareness and understanding of the importance of conserving coastal habitats, and to encourage participation in research and conservation activities.

The research undertaken by the seascape ecology group is multi-disciplinary and underpinned by the use of innovative research platforms, such as acoustic telemetry, acoustic imaging technology, down-scaled sRUVs (remote underwater stereo video systems) for use in nearshore environments and amino acid habitat-specific isotope analysis to unravel patterns in the highly dynamic shallow estuarine and nearshore environment.

In order to impact understanding, learning and participation,

transformation & capacity development are key elements of this research, with strong representation by female scientists, young early-career & black researchers.

Postgraduate students and post-doctoral fellows are trained in the fields of seascape ecology and climate change, through collaborative supervision on innovative research projects. Indicators of this impact for 2022 include three PhD students (Phakama Nodo, Phumza Ndaleneni and Cuen Muller) and two MSc students (Aiden Jacobs and Thembanani Mkhize) who graduated with research theses encompassing seascape change (climate change) and seascape ecology. Thembanani Mkhize registered for a PhD at the end of 2022 and Dr Phakama Nodo is now an NRF Post-doctoral Fellow in the seascape ecology group. As a testament of societal impact towards gender equality and empowerment of women, a highlight for 2022 was the in-person graduation of four female PhDs, who completed between 2020 and 2022, at Rhodes University graduation ceremonies in April and October 2022. This significant milestone is to be celebrated as it advances the breaking of gender barriers in higher education, hence leading to a more equitable society.



The Seascape Ecology Group's all-female PhD cohort from 2020 to 2022 (attended in-person graduation ceremonies in 2022). From left to right: Dr Phakama Nodo, Prof. Nicola James (supervisor), Dr Kerry-Ann van der Walt, Dr Carla Edworthy and Dr Phumza Ndaleneni.

Transdisciplinary shift of narratives to bolster coastal resilience

PROF. FRANCESCA PORRI
SENIOR SCIENTIST

TEAM MEMBERS

Francesca Porri, Kerry-Ann van der Walt, Boudina McConnachie, Paula Patrick, Lucienne Human, Phumlile Cotiyane-Pondo, Eleonora Puccinelli, Rachel Wynberg, Cebo Mvubu, Veronica Betani, Michaela Howse

STUDENTS AND INTERNS

Jabulani Ndaba (PhD), Sipehelele Dyantyi (PhD), Nobuhle Mpanza (PhD)

COLLABORATIONS

RU, Keiskamma Trust, TNPA, NRF-SAEON, NMU, UCT

Coastal ecosystems provide valuable benefits to people.

As the human populations in coastal areas grow, pressure on shorelines increases and can result in over-exploitation of resources and the construction of structures like harbours and coastal defences. This development can lead to the loss of natural habitats for many coastal organisms, reflected in an overall decline in biodiversity. To address these challenges, research is undertaken by members of the NRF-SAIAB Coast and Ocean Sciences Team (COST) to develop innovative ecological engineering approaches to counteract the negative impacts of coastal development and improve the values of coastal urban habitats as well as to define ecological indicators of resiliency in coastal environments. The research combines indigenous knowledge and cutting-edge multidisciplinary techniques, involving collaboration among postgraduate students, members of rural coastal communities, and industry partners. Well embedded in a Theory of Change approach, this action research sustainably addresses multiple impact dimensions, including benefits to the

natural and built environment, the economy (especially of the poorest sector), the quality of life and wellbeing of the society.

Context and Impact

Alleviation of poverty and reduction of social and gender inequalities remain foundational objectives of national (NDP2030) and international (UN SDGs) strategies. Equally serious environmental pressures, however, encompass the maintenance of marine biodiversity and sustainable functioning of coastal ecosystems. Embedded in this complex setup of socio-environmental challenges, the research carried out by the COST at NRF-SAIAB aims to find answers and solutions while engaging with several stakeholders and originally drawing from varied disciplines.

While the primary aim of this research is to have a positive impact on the coastal environment by employing ecological engineering, nature-based practices and improving the value of urban coastal biodiversity, the pathways and indicators of this sphere will only become available in the upcoming years. The transdisciplinary nature of this research underpins impacts on creativity, culture and society, aiming to generate new ways of thinking and new forms of knowledge, hence influencing the creative artistic expressions, as well as the principles



Hamburg, Eastern Cape. A sunset stroll selfie moment taken during the August 2022 Imbizo for the IMIsEE project. From left: Lucky Dlamini, Rachel Wynberg (UCT), Vuyolwethu Mxo, Nobuhle Mpanza, Kerry-Ann van der Walt, Sipehelele Dyantyi, Jabulani Ndaba, Francesca Porri.

of ecological conservation. The community beneficiaries at the Keiskamma Trust, Hamburg, Eastern Cape, by co-creating ecologically-engineered prototypes and artistic manifestations, are at the centre of this interwoven project. During 2022, testimonials by community beneficiaries were collected by the ecomusicology team and will form key material for the relative projects. The IMIsEE biological team had numerous engagements with the Keiskamma Trust community, which culminated with the official opening of the NRF-funded IMIsEE project (through an Imbizo held at the Keiskamma Trust) in August 2022. These continued engagements are crucial to maintain a good working relationship and to monitor the progress of co-creation. Internal committees were formed and roles assigned to help the PhD students to

engage with the multiple collaborators & stakeholders within this transdisciplinary project.

This form of training is a key component of the IMIsEE project, being fully embedded in a Responsible Research and Innovation framework.

From a capacity development perspective, three PhD students were recruited for the biological component of the project and all have completed the collection of data for the pilot studies planned for each of their ecological studies. Two additional postgraduates (one MSc and one PhD) have started projects on ecomusicology at the Music Department at Rhodes University, tackling the links between science and the arts.

The impacts on social welfare and public services are not yet fully measurable, but during this first year of the research, fundamental pillars towards social inclusion and poverty alleviation were set to formalise partnerships through the Memoranda of Agreement between the two academic institutions (NRF-SAIAB and Rhodes University) and the community (Keiskamma Trust).

The uniqueness of these documents lies in the detailed inclusion of recognition and protection of the intellectual property of the co-creation and preservation of the indigenous cultural expressions.

The specific agreement between NRF-SAIAB and the Keiskamma Trust includes the impact on the economy, with evidence of service charge based on the innovative co-creation of the nature-based prototypes by the community beneficiaries. Furthermore, with this research being fully endorsed by the authorities at

the small and large (Transnet National Ports Authority) harbours where most research takes place, it further corroborates the importance of the NRF-SAIAB- industry partnership. This project has a further impact on public participation through the engagements received through social media and online science communication articles.

This research has also shown an impact on animal welfare as the processes undertaken for ethical clearance for the project (both animal and human components) were scrupulous and evidenced a protocol refinement of the euthanasia for marine fish and invertebrate larvae, as well as the fine-tuning of the minimum required number of animals used. This deep institutional engagement for animal welfare procedures is resulting in the drafting of new guidelines for research with aquatic animals at NRF-SAIAB.

Altmetrics

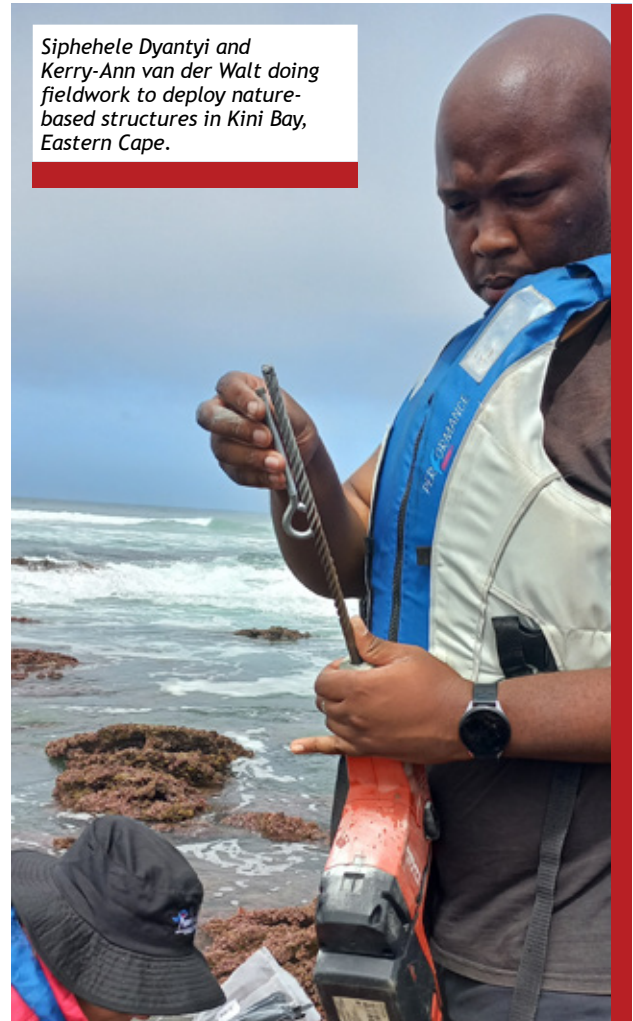
Science article, Traditional African wisdom: A modern answer to protect coastal marine life? published online for the Mail & Guardian 28 November 2022. Audience Circulation: 514,053; Advertising value equivalence: R34 171.20

IMIsEE Imbizo, August 2022. Official opening of the IMIsEE project held in the headquarters of the Keiskamma Trust, Hamburg, Eastern Cape (27 participants)

Bilateral South Africa-Italy Blue Growth Workshop, December 2022 (32 presenters)

Fourteen presentations at national and International conferences and student symposia.

Siphehele Dyantyi and Kerry-Ann van der Walt doing fieldwork to deploy nature-based structures in Kini Bay, Eastern Cape.



Small but mighty: learning more about the movements of estuary-associated mugilids

DR TARYN MURRAY
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SCIENTIST & ATAP
MANAGER

TEAM MEMBERS

Taryn Murray, Matthew Parkinson, Amber-Robyn Childs, Josephine Pegg

STUDENTS AND INTERNS

Dinah Mukhari (PhD), Bantony Ziko (PhD), Samantha Ockhuis (PhD), Melissa Pollard (PhD), Russel Dixon (MSc), Vuyolwethu Mxo (MSc), Kevin Spiby (MSc), Thembelihle Ndlovu (MSc), Elihle Mankuntsu (BSc Honours), Godfrey Padare (Intern)

COLLABORATIONS

RU, NRF-SAEON, ORCA Foundation, Two Oceans Aquarium, CPUT, Nature's Valley Trust, Institute for Coastal and Marine Research, NMU

Estuaries are highly productive ecosystems, serving an important nursery function for many estuary-associated species. Additionally, these ecosystems provide fishery opportunities for both subsistence and recreational users, which are

important for income generation & food security, particularly for vulnerable coastal communities.

Despite their small size, mullet species dominate the catch composition of estuarine fisheries in South Africa, with caught individuals used either as live bait to target bigger piscivorous species, or as a food source, predominantly for subsistence fishers. Additionally, mullet species are good biological indicators for the health of an estuarine ecosystem, and therefore play a key ecological role.

The study of animal movements is an essential aspect in informing management and conservation measures. Larger-bodied estuary-associated species which are generally more targeted by estuarine fishers, have been the focus of much movement behaviour work in South Africa; however, small-bodied and juvenile fish communities, including mullet species, dominate estuarine ecosystems, many of whose movements remain largely unknown, despite good biological information. As such, the research tackled in 2022 aimed to assess the movements and habitat connectivity of mullet species in the Kowie Estuary, Eastern Cape, with results providing knowledge critical to the greater understanding of the ecology of this important fish group.

Context and Impact

Despite estuaries being among the world's most biologically productive and economically valuable environments, they are also amongst the most modified aquatic systems, threatened by an array of anthropogenic activities, including infrastructure

development and water abstraction which result in either habitat alteration or destruction, and pollution from both industrial and agricultural sources. All these pressures, in turn, can threaten estuary-associated fishes. Changes in water temperature, related to climate change could also have a major impact on estuarine-associated species. Lastly, but most importantly, exploitation has been identified as the single biggest threat to estuary-associated fishes in South Africa.

Mullet are estuary-associated species that have considerable fisheries potential. Because of this, their conservation and controlled exploitation should be given high priority. However, in order to manage and conserve aquatic animals successfully, knowledge of movement ecology is required. A better understanding of the movement patterns of mullet species within estuaries is critical to understanding their ecological function. The effects of climate change (e.g., droughts, storms, increasing severity of upwelling cells) may have on these fishes can also be predicted. Additionally,

understanding the biological health of these fishes is important to understand the potential impact pollution may be having on their well-being, especially when fishes are for human consumption.

This research addresses the movements of several mullet species (grooved mullet, *Chelon dumerili*, striped mullet, *Chelon tricuspidens*, and flathead mullet, *Mugil cephalus*) in a modified warm-temperature estuary using a multi-method approach. Acoustic telemetry is used to gain a better understanding of the movements of mullet within the Kowie Estuary and the adjacent marine

and estuarine environments, providing a movement snapshot in the life histories of the tagged fish, while otolith microchemistry is used to examine transitions between estuary and marine habitats over their entire life histories.

Additionally, because climate and associated weather are anticipated to change along the South African coastline, potentially influencing the movements of important fishery species, thermal tolerance experiments are employed to determine whether warming or cooling waters impact the health and well-being of mullet species. Ultimately, the results of this study can be used towards the development of a small-scale mullet fishery for fishers living in the area, which could potentially

be suitable for other estuaries along the coastline, too. Not only will this have a positive impact on the health, wellbeing and social welfare of impoverished people, but also on the economy, given appropriate management of the system.

Altmetrics

Two research agreements between NRF-SAIAB and the Eastern Cape Parks & Tourism Agency to conduct research in the Kowie River (which falls within Waters Meeting Nature Reserve).

NRF-SAIAB Summer School attendees (10 undergraduate and postgraduate students) assisted in catching and tagging mullet.



PhD students, Bantony Ziko (left), Dinah Mukhari (centre) & Vuyolwethu Mxo (right), pulling a seine net in the Kowie Estuary in an attempt to catch some mullet (top photo) to tag acoustically.

Seafloor Ecology and Sustainability (SEaS)

DR ANTHONY BERNARD
INSTRUMENT SCIENTIST
& MARIP MANAGER

TEAM MEMBERS

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COLLABORATIONS

RU, Wild Oceans, Wildlife Conservation Society, SANBI, NMU, ORI, Namibia Nature Foundation, NEKTON Foundation

The SEaS research group aims to advance the sustainable management of seafloor ecosystems

by i) improving sampling methodologies and research capacity; ii) creating foundational knowledge; iii) understanding how global change and management decisions influence ecosystem components and structure; iv) determining societal opportunities and costs associated with management actions, and v) supporting policy- and decision-making. This research builds on the foundation provided by the Marine Remote Imagery Platform (MARIP) and aims to mainstream underwater observation-based research to support effective management.

Seafloor ecosystems are highly valued by a diverse range of stakeholders for their provisioning, cultural, supporting and regulatory services. In many instances, economic incentives and competing interests have led to unsustainable activities and conflict among stakeholders, and between stakeholders and management. Improving knowledge of the ecology, the impacts of global change and the social-ecological systems is fundamental to support sustainability and effective management. The SEaS group addresses this need by implementing and supporting research activities within our five thematic areas.

Context and Impact

Seafloor ecosystems have been utilised by human societies for millennia, which has developed strong interconnectedness and reliance on the ecological services for sustenance, livelihoods, recreation and cultural/spiritual identity. Burgeoning coastal populations, improved accessibility, climate change and industrialisation have, however, negatively impacted, and continue to undermine, the societal benefits provided by seafloor ecosystems. Nowadays, the impacts of human activities are extensive, spreading across the globe and extending from the intertidal into the abyss. To ensure that we can continue to benefit from seafloor ecological services, research and outcomes that advance

sustainability need to be prioritised. Relevant and reliable knowledge is the key to ensure that outcomes benefit society and sustainability.

Historically, carrying out research on seafloor ecosystems has been challenging and, until recently, most research required the collection of animals, which was associated with their mortality and the destruction of habitats. Advances in digital cameras and remote sampling techniques have provided opportunities for wide-scale responsible and ethical research. Within the SEaS research group, we rely on underwater cameras to conduct research on benthic and demersal fishes, and considerable effort is invested in strengthening the capabilities and knowledge-base for these tools. Over the last five years, we have been developing lightweight lander platforms, capable of transporting scientific cameras and other instruments into the deep-sea. In September 2022, we had the opportunity to join the NEKTON Foundation First Descent Cruise to the Maldives where we used the landers fitted with baited remote underwater stereo-video systems (stereo-BRUVs) to survey seafloor fishes and macro-invertebrates from depths of 250 to 900 m. This was our first major survey with this equipment and marked a milestone in our deep-sea research capacity. The data that we collected will be used by Maldivian researchers to support management of their deep-sea ecosystems, while the SEaS group will use the data to optimise sampling protocols and better understand the strengths and limitations of the datasets.

The research community is a key stakeholder when considering the sustainable development of seafloor ecosystems as knowledge exchange, capacity development and collaboration can advance research activities and impact. In 2022, the SEaS group provided training for the stereo-BRUVs research method to scientists from South Africa, Namibia, Mozambique, India and the Maldives. This training aligned with global methodological standards with the aim of encouraging researchers to collect comparable datasets that can be used to address regional and global scale research priorities. In addition, we received support from the Scientific Committee on Oceanic Research (SCOR) to establish a Working Group that aims to advance our understanding of the complementarity and

interoperability of data collected by different Coastal and Nearshore visual CENSUS methods (Working Group 164: CoNCENSUS) to track changes in benthic and demersal fish populations in relation to global change. The Working Group brings together researchers from around the world with the aim of strengthening the community of practice and determining which ecological indicators respond to global environmental and disturbance gradients consistently among the dominant visual census method. The outcomes of this will enable standardised and effective reporting on essential ocean variables from local to global scales.

Marine spatial and adaptive management, which forms the basis for the sustainable development of the oceans, requires relevant ecological datasets to develop plans and then track the spatio-temporal ecological response once the management plan is established. Unlike land-based ecosystems, seafloor ecosystems are hidden from view and most stakeholders are unable to observe their condition or understand how they are changing. Consequently, data and video imagery are essential to convey this information. In 2022, the SEaS team contributed our stereo-BRUVs dataset for elasmobranchs (133 632 presence/ absence records for 83 species) to a national initiative, led by Wild Oceans NGO, to develop a systematic conservation plan for improved sustainable management of chondrichthyans in South Africa.

A new project was initiated to improve the management of the uThukela Banks marine MPA and improve our understanding of the effect of the KZN MPA network on linefish species and elasmobranchs, and the commercial linefishers from the region. This feeds into the ACEP SMART Zone project and the Blue Action Fund uThukela Banks management support project led by Nelson Mandela University and Wild Oceans. In 2022, baseline surveys of the offshore reefs (40-200m depth) within the uThukela Banks MPA were completed. This data will allow us to develop a feasible long-term monitoring programme to support the MPA management and, when combined with existing datasets from the region, allow us to measure

the overall ecological response to the KZN MPA network. Human social systems are interconnected with, and inseparable from, marine ecosystems and it is becoming apparent that sustainability challenges can benefit from a social-ecological systems approach. Therefore, data on the perceptions of commercial linefishers regarding the ecological, social, and governance impacts of MPAs and their management were collected for KZN. These data will help us understand the sustainability and management issues, and better measure the effectiveness of the KZN MPA network by incorporating social-ecological perspectives.

Altmetrics

MOAs/MOUs

Namibia Nature Foundation: To initiate a mutually beneficial collaboration by undertaking research, student training, and scientific awareness in the fields of remote imagery in Namibia.

NEKTON Foundation: to cross-promote and conduct scientific studies related to baited remote underwater stereo-video systems (stereo-BRUVs) and remotely operated vehicle (ROV) operations during NEKTON's research expedition in the Maldives in 2022.

Presentations

Symposiums: Five presentations at WIOMSA 2022; one presentation Sharks International 2022; five presentations SAMSS 2022.

Special sessions: Presentation at the SAMSS Computer Vision Workshop on "Current status and future opportunities for visual census of fishes in South Africa".

Public presentations: On-line talk for MPA day highlighting how observation-based research has strengthened the case for Marine Protected Areas.

Representation on committees, panels & working groups

GOOS BioEco Panel Member

National Marine Biodiversity Working Group

National Marine Ecosystem Committee

Co-Chair on SCOR Working Group 164: CoNCENSUS



The stereo-BRUVs lander being deployed at dawn off Fuvahmulah Island in the Maldives. Photo credit: Henley Spiers, © Nekton 2022

Assessment of fish assemblages using environmental DNA (eDNA)

DR GWYNNETH MATCHER
INSTRUMENT SCIENTIST
& AGRP MANAGER

TEAM MEMBERS

Gwynneth Matcher, Anthony Bernard, Kerry Sink, Ryan Palmer

STUDENTS AND INTERNS

Mpilo Nyawo (PhD), Jody Oliver (PhD)

COLLABORATIONS

SANBI

Marine ecosystems are under severe pressure to meet resource demands from human populations. Furthermore, global climate change and the impacts of human disturbances place additional stress on marine organisms. Improved understanding of the biodiversity and habitat utilisation of fish assemblages is essential for the effective management of our marine environment and the accurate understanding of the impact of resource use. With species and ecosystems under growing pressure, there is recognition that assessment of vulnerable ecosystems needs to be non-destructive and non-invasive. This can now be achieved thanks to advances in molecular research, decreased costs of next generation sequencing, and the targeted use of environmental DNA (eDNA).

eDNA refers to DNA that is shed by target species into their surrounding environment & which can then be extracted from abiotic environmental samples

such as water, soil, and air. In the marine environment, eDNA is a rapidly growing approach worldwide for non-invasive provision of fish biodiversity evaluations that provides a valuable complement to the already existing surveys and biodiversity assessment methods, such as baited remote underwater stereo-video systems (BRUVs).

The research conducted by NRF-SAIAB in 2022 focused on the use of eDNA to assess fish biodiversity in shallow reefs within and outside Marine Protected Areas, and the assessment of the understudied deep canyon (100-200 m) fish assemblages.

Context and Impact

The research conducted by NRF-SAIAB in 2022 focused on three research topics: i) the use of eDNA to assess fish biodiversity in shallow reefs within and outside of Marine Protected Areas (MPAs) along the Garden Route (Tsitsikamma and Nature's Valley), in Algoa Bay and along the Wild Coast (Mdumbi and Dwesa Cwebe) in

order to assess the efficacy of the MPAs as a refuge for aquatic biota; ii) the assessment of the currently limited studies on deep canyon (100-200 m) fish assemblages; iii) the utilisation of eDNA to detect and determine the distribution range of the iconic coelacanth (*Latimeria chalumnae*).

The MPAs are areas of the ocean that are set aside and managed for conservation purposes, and they are a crucial tool for conserving marine biodiversity and maintaining ecosystem services. These areas function as a haven for fish species as protection from overfishing; they safeguard marine biodiversity, prevent extinction events, preserve of genetic diversity, and they maintain healthy marine ecosystems. The MPAs provide protected areas for fish to breed and play, an important function as a nursery habitat to allow fish to reach maturity (overfishing of species before they reach reproductive maturity is a primary cause of extinction). This, in turn, is beneficial to the fishing industry as MPAs provide a source of fish larvae and larger adult fish which migrate out from the MPAs, thereby replenishing fish stocks. The MPAs have an additional impact in the tourism industry which also supports local economies and communities.

eDNA studies, in conjunction with baited underwater video (BRUV) assessments inside and outside of MPAs in three distinct regions of the South African coastline, were completed in 2022. The final stages of the analyses are currently underway, and preliminary data show that the eDNA methods are able to pick up almost all of the fish species observed with BRUV assessments, with additional species detected by eDNA that were not observed by BRUV. This indicates that eDNA provides a useful complementary tool to that of BRUVs and can detect species that do not swim into view of the camera.

Deep canyons (>100 m below the sea) are home to a wide range of marine fish; however, the canyons are often overlooked in biodiversity assessments and little is known of these deep-sea environments off the coast of South Africa. Deep canyons are important fishing grounds for commercial and subsistence fisheries. By studying the diversity of fish in these habitats, scientists can identify key species and habitats that are important for fisheries, as well as potential threats to these fish species, including overfishing and habitat destruction. Owing to the deep-sea nature of these canyons, they are less sensitive to the effects of climate change and may function as a sanctuary for fish species sensitive to the effects of sea warming

and acidification. To date, research on deep canyons has typically been conducted by remote underwater vehicle (ROV) (which is limited by the fish species which are located directly in the view of the camera), or trawl studies which, while informative, are destructive methods of biodiversity assessments as they involve the death of the collected specimens. eDNA presents an attractive complement to these methods in that it is non-destructive, and includes all species present in the water body. Research undertaken in 2022 involved collection of water samples from several deep-water canyons off the east coast of South Africa. Genetic material has been extracted from these water samples, and sequence analyses to determine the identity of the fish species present in the deep canyons is currently underway. The coelacanth is the iconic prehistoric fish that was thought to be extinct until its rediscovery in 1938. It is listed as a critically endangered species due to its low population size and restricted distribution. Coelacanths are extremely rare and are found only in Indonesia and along the eastern coastline of southern Africa.

Coelacanths are of cultural & heritage significance & should be preserved for future generations. Studying coelacanths can help inform conservation efforts to protect this species

which is usually found in deep waters (>100 m), making the study of this iconic species extremely difficult. Little is known of their distribution range beyond the visual sightings conducted by ROV camera footage. Current research efforts aim to apply eDNA to assist in determining the distribution range of these fascinating creatures. Water samples have been collected and assessment of the eDNA in the water is currently underway.



Jody Oliver (PhD student) filtering water for eDNA studies to determine the distribution range of the coelacanth.

From the bottom up: geology as the basis for ecosystem services that benefit society

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STUDENTS AND INTERNS

Thamsansqa Wanda (PhD)

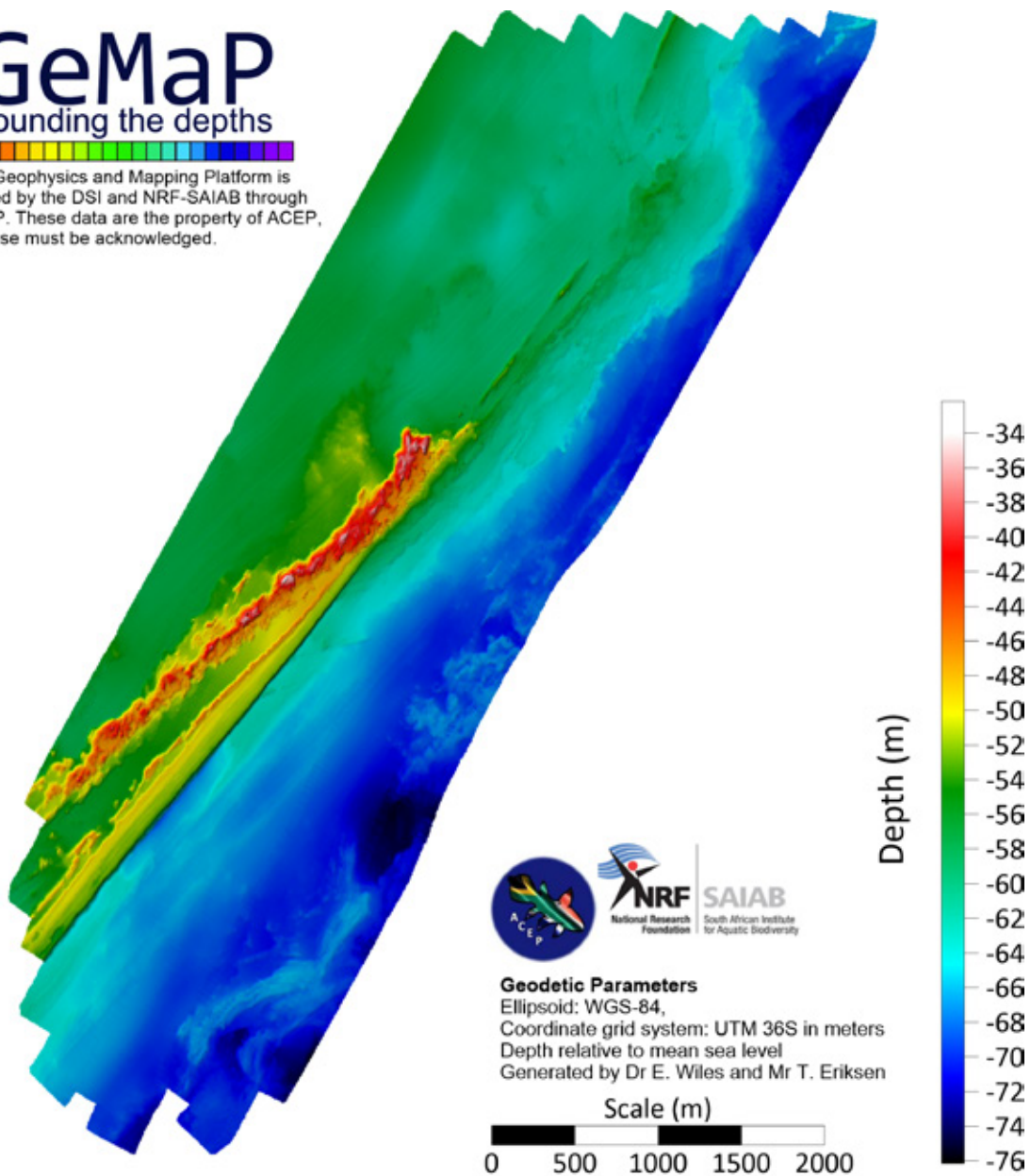
COLLABORATIONS

UKZN, UNIZULU, NMU, Oxford University, Stirling University, Wildlands Conservation Trust, Ezemvelo KZN Wildlife, eThekweni Municipality, Council for Geoscience, NRF-SAEON

GeMaP

sounding the depths

The Geophysics and Mapping Platform is funded by the DSI and NRF-SAIAB through ACEP. These data are the property of ACEP, any use must be acknowledged.



Bathymetry data from the central uThukela Banks Marine Protected Area. Extensive submerged shorelines created varied relief on the seabed. These reef complexes provide critical marine habitats within the Marine Protected Area, thus driving east coast biodiversity. These data were collected for the ACEP SMART Zone MPA project by the Geophysics and Mapping Platform.

Initiatives such as the Agenda 2063, Africa Blue Economy Strategy 2019 and 2030 aim to improve quality of life while sustainably enhancing productivity of the Blue Economy through new data, ground-breaking research, and sharing new knowledge.

The continental shelf and coastal zone play host to a wide variety of anthropogenic activities and natural processes ranging from maritime trade, recreation, and tourism to biological habitat provision. There is an ever-increasing pressure on resources as coastal populations and maritime trade grow rapidly. Such growth, although good for the immediate economic growth of countries, impacts the functioning of the coastal zone and adjacent continental shelf with long-term negative effects.

There are two primary research themes addressed from a geological perspective: coastal zone shoreline migration and geospatial context of the continental shelf. In the case of the coastal zone, and beaches in particular, our team analyses shoreline migration; how size and position of the beach changes over time and what this means for coastal communities and infrastructure. In terms of the continental shelf, the seabed is mapped using a multibeam echosounder to create three-dimensional models. The geology and geomorphology of a region is critical to that region's response to pressure (natural or anthropogenic). The distribution of reefs, the type and composition of sediment, the size of beaches, not only play a role in biological habitat provision for fauna and flora, but also drive tourism, fisheries, recreation, and act as a buffer against flooding. In order to understand the role that these physical characteristics play in society, we must understand their functioning and evolution over time.

Context and Impact

Sandy beaches are buffer zones between the marine and terrestrial setting. In addition, they hold high touristic value, reduce the risk of coastal flooding, and host recreational and subsistence fishers. The propensity for building infrastructure in the coastal zone (roads, buildings) creates a conflict between shoreline migration (and associated flooding, erosion, etc.) and fixed infrastructure. The resulting coastal hazards place socio-economic strain on growing coastal populations. Understanding shoreline migration can have an environmental impact as it helps inform future coastal management strategies, thereby reducing risk of losses.

Research published in 2022, focusing on Mossel Bay (Western Cape) and the Durban Bight (KwaZulu-Natal), found that beach dynamics change naturally over time. Beaches respond to these changes by growing larger or smaller (changes in area and/or volume) and

by migrating landward or seaward. Issues arise when human activities prohibit, or otherwise impact, the natural system functioning, particularly on a seasonal scale. Such activities include coastal infrastructure (built environment) set too close to the shoreline, thus restricting landward migration of the beach, and dams within river catchments critical to coastal sediment supply. In terms of coastal infrastructure, landward shoreline migration within Mossel Bay has resulted in the loss of parking areas, ablution blocks and beach area, impacting residents and tourists who are now unable to enjoy the natural resource to its full potential. Similarly, dams, which are crucial developments for water security, significantly alter the sediment transport potential of rivers. As sediment supply to sandy beaches of the Durban Bight is reduced by such dams, so too is the stability of the associated beach. While natural transport of sediment by wave action continues, the sediment input to the system has been reduced. The result is often long-term erosion of the beach sediment.

Unless beach nourishment schemes are put in place, it is likely that erosion will continue.

Ongoing continental shelf research covers large, multi-disciplinary projects as well as small-scale focused projects. In particular, multibeam bathymetry data collected under the ACEP SMART Zone MPA project have revealed a diverse range of seabed characteristics in key sites between Durban and Richards Bay. PhD candidate, Mr Thamsanqa Wanda, is currently analysing these data to understand how the geology and geomorphology of the seabed impacts biodiversity through habitat provision. The depth at which reefs are located, the size of area covered by reef, and the type of seabed sediment all contribute to the ecosystem as the basis for different marine habitats.

There is significant variation in reef shape and dimension throughout the uThukela Marine Protected Area. Furthermore, the reef complexes most likely represent old shorelines developed during periods of significantly lower sea level, up to 100 m lower than present. We now know that these preserved shorelines are drivers of east coast biodiversity through habitat provision within the Marine Protected Area. From a geomorphological perspective,

this research suggests the importance of the uThukela Marine Protected Area and associated reefs as drivers of east coast biodiversity and shoreline.

EXPLORE

Platform Provision &
Infrastructure Development





African Coelacanth Ecosystem Programme (ACEP)

RYAN PALMER

**ACEP TECHNICAL
& SCIENTIFIC
MANAGER**

PLATFORM USERS

NMU, RU, SANBI, UCT

METRICS

Vessel days in 2022 = 136

Researchers gaining access to ACEP Platforms = 69

Peer-reviewed publications acknowledging ACEP = 19

Post Graduate students = 45

The African Coelacanth Ecosystem Programme (ACEP) is a flagship programme of the DSI implemented by NRF-SAIAB.

The ACEP partners with DFFE, NRF-SAEON, SMCRI and NRF-SAIAB, and has been directly aligned with the Global Change Grand Challenge, NRF Vision 2015, the Marine and Antarctic Research Strategy 2016, and the 2030 Agenda for Sustainable Development.

The previous phase of ACEP linked in with Operation Phakisa Ocean Cruises and formed a key contribution by the Department of Science and Innovation (DSI) and NRF to Operation Phakisa. In addition, ACEP projects, by and large, address research objectives identified by other Government Departments such as the DFFE. Research priorities drew from the National Biodiversity Assessment 2019, in addition to the above-mentioned strategy documents. Within the NRF's strategic goals ACEP aims to: i) promote internationally competitive research as the basis for a knowledge economy; ii) grow a representative science and technology workforce

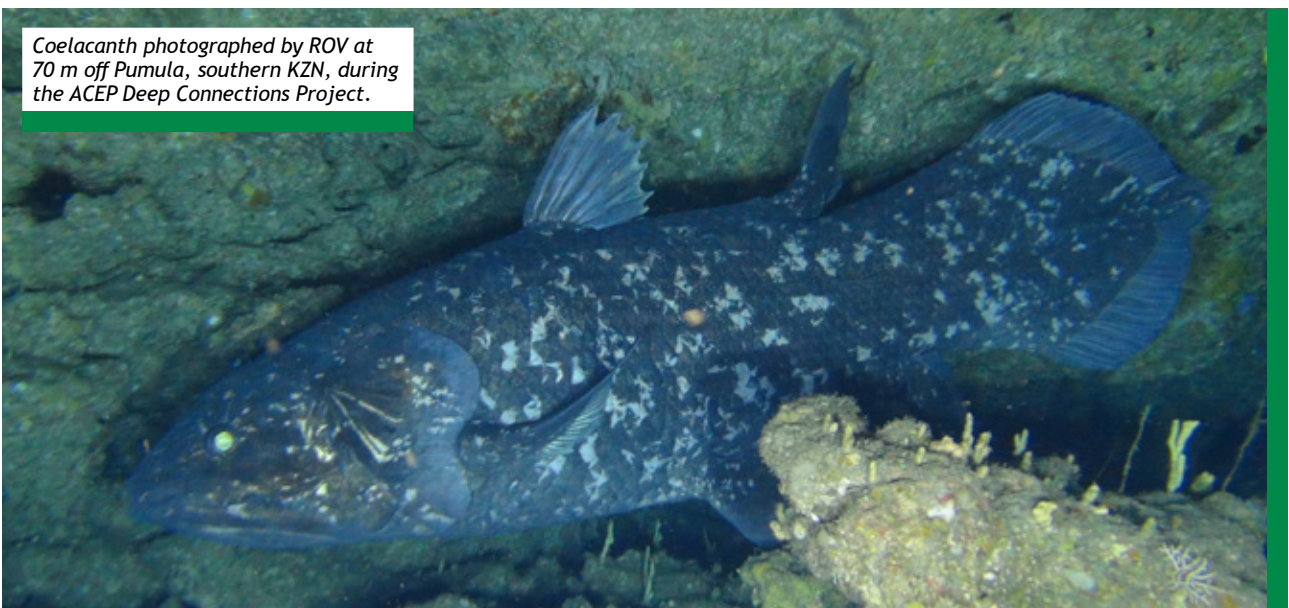
in South Africa; iii) provide cutting-edge research, technology and innovation platforms; iv) operate world-class evaluation and grant-making systems; v) contribute to a vibrant national innovation system.

The ACEP is a competitive, open research programme that links researchers with equipment or expertise not normally available at Higher Education Institutions. The programme runs on a three-year rolling funding cycle, the previous cycle having run from 2018-2020, the current one running from 2021-2023.

A key facet of ACEP is the provision of research infrastructure to the NSI.

The NRF-SAIAB currently manages four research platforms: the National Coastal Craft Fleet, the National Acoustic Tracking Array Platform (ATAP), Marine Remote Imagery Platform (MARIP), Geophysics Mapping Platform (GeMAP). Each of these platforms has dedicated personnel, including technicians and instrument scientists. Platforms are accessed primarily on a competitive basis through the ACEP, and awarded projects are provided with logistical, technical, and specialist support by instrument technicians and scientists.

Coelacanth photographed by ROV at 70 m off Pumula, southern KZN, during the ACEP Deep Connections Project.





Context and Impact

The objectives of the ACEP programme are to: i) integrate the physical and biological sciences to understand the processes that govern the South West Indian Ocean (SWIO) ecosystem functioning; ii) understand biological processes, and climate and global change; iii) determine species richness, biodiversity and biogeography of the SWIO; iv) provide recommendations for SWIO conservation, management strategies and long-term sustainability; v) build capacity in offshore marine sciences, particularly developing a critical mass of skilled personnel while addressing equity imbalances; vi) build capacity in Marine Sciences at Historically Disadvantaged Institutions; vii) provide public awareness and understanding of marine science; viii) generate knowledge and build integrated and shared marine information systems, including geographic information systems (GIS); ix) promote ACEP as a platform for national, regional and international partnerships; x) support the sustainable development of the Blue Economy.

In 2022, through the ACEP Open Call, four multi-disciplinary projects were awarded:

Agulhas Bank Connections (Dr Natasha Karenyi - UCT)

The multi-disciplinary Agulhas Bank Connections (ABC) project aims to

improve our understanding of land-sea connectivity, social-natural connectivity, biodiversity of muddy ecosystems, ecological processes & population connectivity across the Agulhas Bank.

Further, the ABC project aims to incorporate these elements into ecosystem mapping, assessment and spatial management. The project also addresses the common public misconception that water flowing from the river into the ocean is wasted. Rivers carry sediment to the estuaries and the ocean, likely sustaining marine mud ecosystems, which are essential for commercial fish species such as hake and sole.

SmartZone MPA (Prof. Amanda Lombard - NMU)

Using the new uThukela Marine Protected Areas (MPA) as a case study, this multi-disciplinary project uses a

rare, time-sensitive opportunity to gain a social-ecological baseline essential for future assessment of achievement of MPA objectives.

Generated data will underpin an evidence-based approach to adaptive management of the MPA in a 'SMART' framework. This framework defines Specific objectives for the MPA; develops Measurable success indicators; sets Achievable goals, given limited resources for management; ensures monitoring findings are Relevant for biodiversity and people; and provides Time-bound outputs.

Deep Connections (Prof. Kerry Sink - SANBI)

The Deep Connections Project is a multi-disciplinary and multi-institutional project aimed at

building knowledge on genetic, physical, and socio-cultural connectivity to improve biodiversity monitoring, spatial assessment & prioritisation.

This broad aim is achieved by piloting novel approaches across the biodiversity value chain. The project is making the science easily accessible, through theatre, children's stories, an exhibit and social learning to foster an emotional connection to the ocean while increasing socio-cultural exchange and advancing research on human dimensions of marine protected areas (MPAs).

Assessing the role and efficacy of marine protected areas in maintaining the climate resilience of fish populations - A South African case study (Prof. Warren Potts - RU)

Fish are facing increasing threats from the combined impacts of climate change and exploitation. The research team leading this research has recently shown that

exploitation removes high performance physiological phenotypes (HPPP) from populations which has a negative impact on fish populations during thermal extremes.

This finding suggests that exploited populations may be at greater risk in a changing environment and highlights the potential value of marine protected areas (MPA) in maintaining and exporting HPPPs to promote population resilience. Before proclaiming MPAs as the panacea for population resilience, however, we need to better understand the mechanisms driving the observed patterns and whether findings apply beyond a single species and a single MPA. Through this project, an interdisciplinary research team i) builds on our knowledge of the value of MPAs in promoting the resilience of fishes to climate change; ii) assesses the efficacy of South Africa's MPA network in maintaining and exporting this resilience, and iii) improves the fishers' perceptions of, and compliance to MPAs.



Aquatic Ecophysiology Research Platform (AERP): Interdisciplinary approaches to promote coastal resilience in the Anthropocene

SESHNEE REDDY
AERP
CO-ORDINATOR

PLATFORM USERS
IRD, RU, UP, University of Southampton

Coastal fishery resources support small-scale, recreational and commercial fishing sectors and are critical for the well-being of coastal communities. Unfortunately, coastal resources are being threatened by the impacts of climate change, over-exploitation of resources, and the construction of structures, for example, harbours and coastal defences. These pressures can lead to changes in the resilience of these ecosystems, reflecting in an overall loss of functionality and decline in biodiversity.

To address this challenge, members of the Southern African Fisheries Ecology Research Laboratory (SAFER Lab) at Rhodes University and the Coast and Ocean Sciences Team (COST) at NRF-SAIAB have been researching methods to improve the resilience of coastal systems.

The SAFER Lab focusses on understanding the impacts of exploitation on the physiological characteristics of fish populations and uses these findings to

*propose solutions to
improve the resilience
of these populations to
climate change*

in and outside marine protected areas. The COST aims to develop innovative ecological engineering approaches to counteract the negative impacts of coastal development and improve the values of coastal urban habitats, as well as to define ecophysiological indicators of resiliency in the coastal environment. This research sustainably addresses multiple-impact dimensions, the economy, and the quality of life and wellbeing of the society.

Context and Impact

SAFER Lab: Participation in South African coastal fisheries is high, with approximately 3000, 30 000 and 750 000 commercial, small-scale and recreational fishers, respectively. While these fishers rely on coastal species for their livelihoods and recreation, the industries associated with these activities provide large numbers of jobs (e.g., 94 000 in tourism associated with recreational fishing). Maintaining sustainability in these fisheries and the livelihoods in a rapidly changing climate is critical to achieve the Sustainable Development Goals of no poverty, zero hunger, good health and well-being, decent work and economic growth, sustainable communities, responsible consumption. This can only be done through



climate action research on life below water. In 2022, the aim of the team was to conduct physiological research that could be used to make practical recommendations for improving the resilience of exploited coastal fish populations to the impacts of climate change.

The comparative physiology research on fish populations inside and outside MPAs, by MSc students, Xolani Nabani and Nonhle Mlotshwa, confirmed that exploitation with hook and line removes high-performance phenotypes (individuals that can deal with environmental variability). PhD student, Cuen Muller, also found that these physiological traits are passed on to the next generation and that offspring of fish from exploited environments are less competitive in future environmental conditions. PhD student, Lauren Bailey, examined the relationship between fish behaviour and physiology and found clear link between boldness (behaviour that is susceptible to fishing) and high-performance physiological phenotypes.

These findings suggest that exploitation will not only change the physiological traits of fish populations, but also their susceptibility to capture. This information, together with the information collected from other MPAs and exploited areas, has been used by SANBI to



support the promulgation of additional marine protected areas as these will increase the resilience of fishes to the impacts of climate change and maintain the sustainability of coastal fisheries. Recommendations for behavioural changes in the recreational fishery were also made, which would include reducing fishing effort during thermal extreme events which would reduce the removal of high-performance phenotypes, which are still capable of activity at thermal extremes.

These findings were presented at several local and international conferences and the ideas are beginning to gain traction on the international stage. It is hoped that this research will spur several research programmes, locally and around the world and will, in so doing, promote the concept of actively implementing climate resilient fish populations through protected area networks.

From a human capacity development perspective, Caitlin Allison graduated with an MSc and Cuen Muller with a PhD, while Lauren Bailey (PhD), Xolani Nabani, and Nonhle Mlotshwa (MSc) submitted their theses as part of this project. These students all presented their findings at local or international conferences during 2022, where they developed valuable science communication experience and developed their own collaborative networks.

COST: Intertidal habitats are rich in biodiversity and are important as nursery areas for early-stage invertebrate and fish species. The escalating global trend of growing human populations along the coast, however, has led to the replacement of these habitats with artificial infrastructures, thereby impacting the biodiversity and processes that regulate populations. Urbanisation, combined with rising mean ocean temperatures

and local temperature variability, imposes ecological and physiological pressures on these early life stages. To comprehensively assess the ecological challenges associated with coastal urbanisation and to establish reliable knowledge on the functioning of early life stages in the face of anthropogenically mediated changes within urban coastal systems, the thermal performance of dominant selected invertebrate larvae collected from one urban marina was determined in 2022.

Preliminary findings from examining the oxygen consumption results of (early) zoeal and (late) megalopal life stages of selected brachyuran crabs at various test temperatures indicate that the thermal performance during the zoeal stage may be susceptible, starting from 22 °C, within natural and artificial habitats. The physiological component of the research suggests that the earliest life stages of crabs could be the most vulnerable to thermally stressful events such as marine heatwaves, which are projected to increase in frequency and intensity in this region, implying potential risk to maintain viable populations.



*Lauren Bailey & Xolani Nabani
undertaking physiology
experiments in the laboratory*



Aquatic Genomics Research Platform (AGRP)

DR GWYNNETH MATCHER
INSTRUMENT SCIENTIST &
AGRP MANAGER

PLATFORM USERS

Albany Museum, CPUT, DFFE, NMU, ORI,
 Plymouth University, RU, SANBI, UCT, UFH, UJ,
 UNISA, University of Regina, UWC, WSU

METRICS

Number of users = 96
 Number of capillary sequences generated = 218
 Number of NGS metabarcoding libraries
 sequenced (Illumina) = 988
 Number of whole genome sequence dataset
 generated = 2
 Number of metagenomics data sets (Nanopore) = 2

The Aquatic Genomics Research Platform (AGRP) provides infrastructure, access to specialised equipment and workspace for researchers in the field of aquatic genomics. It is strongly positioned for its link to the National Fish Collection, the NRF-SAIAB biobank, and to active researchers in the aquatic biosphere. By

articulating key strategic areas where the application of genomics can support improvements in government decision-making, industry and communities, the platform provides a national genomics infrastructure for aquatic research,

prioritising and supporting research that leads to sustainable use and of aquatic resources, as well as human health and wellbeing, specifically linking to the global Sustainable Development Goal 14.

Research undertaken using the AGRP includes both freshwater and marine sectors, and leverages research related to aquaculture, aquaponics, bioprospecting for pharmaceuticals, biodiversity, barcoding, ecology and genome studies. The AGRP is fully furnished with laboratory equipment for capabilities that extend from DNA extraction through to Sanger sequencing, as well as next-generation sequencing (Illumina (MiSeq) and Oxford Nanopore (Mk1C)). High-performance computational hardware in the form of a server with 2TB RAM was acquired in 2019 that enables the analysis of the large datasets generated by next-generation sequencing. Primarily, the server has been used for the assembly of genomes from metagenomics data.

The AGRP operates on a cost-recovery basis, thereby allowing South African researchers access to equipment



Genomics research starts with the purification of DNA from samples of interest; students in the Aquatic Genomics Research Platform laboratory working on their projects.



and training that would otherwise be unaffordable, and hence strongly impacts the advancement of aquatic research in the country while maintaining high standards in the training and upskilling of emerging young researchers.

Context and Impact

The research projects pursued in 2022, utilising the AGRP resources and infrastructure, were varied and ranged from fundamental research through to more applied topics, which in turn, have high societal impact, contributing to the understanding and conservation of aquatic ecosystems - which are vital to ensure sustainable utilisation of food resources, for recreation, the tourism industry and biodiversity. Additionally, the genomics research projects conducted in the AGRP, focusing on aquaculture and aquaponics, can help to address food security challenges in South Africa and beyond.

Characterisation and barcoding of the rich aquatic biodiversity in South African waters (both fresh and marine) are central to our understanding of ecosystem functioning and health, thereby facilitating informed management of our resources and allowing for maximum sustainable economic utilisation while maintaining ecological functionality and biodiversity. Research carried out in 2022 by projects accessing the AGRP includes characterisation of fish and abalone gut microbiomes in aquaculture, antibiotic resistance profiles of bacteria, and bioprospecting. Microorganisms and marine invertebrates are an extremely rich source of novel bioactive compounds with potential impact on human health for applications in the biopharmaceutical and drug discovery industry for the treatment of antibiotic-resistance pathogens, TB, cancer, HIV, and more. Many of these compounds are synthesised by

microorganisms that cannot be cultured; thus, in order to discover and harness these potentially life-saving novel compounds, the metabolic pathways need to be elucidated using next-generation sequencing technologies (such as those utilised within the AGRP).

The AGRP platform is also an

invaluable teaching resource, reflected in national impacts on understanding, learning and upskilling of people in this field of science.

Staff provide technical support to all platform users, allowing those with little or no practical experience to gain the skills needed to answer their research questions, obtain their qualifications (in the case of MSc/ PhD students) or pursue a career in the field of molecular biology. Nationally, the AGRP is the only platform that offers this type of hands-on, high standard training. In 2022, the platform was utilised by 96 students and staff and included researchers from 15 institutions. The platform also hosted the annual workshop on next-generation sequencing, dataset curation/quality assurance and metabarcoding data analysis. This included hands-on practical experience in analysing metabarcoding data (from dataset curation all the way through to generating publication-ready graphs). Individual one-on-one training was also supplied for barcoding, qPCR and shotgun metagenomics.



Preparation of metabarcoding libraries for Next Generation Sequence analysis by Rhodes University PhD candidates Petronilla Mwangudza and Moqebelo Morallana in the Aquatic Genomics Laboratory.



Acoustic Tracking Array Platform (ATAP): a successful ocean stewardship programme

DR TARYN MURRAY
INSTRUMENT
SCIENTIST & ATAP
MANAGER

PLATFORM USERS

Bayworld, Dyer Conservation Trust, East London Museum, Marine Dynamics, Namibian Nature Foundation, Norwegian Institute for Nature Research, ORI, RU, SANParks, Shark Spotters, South African Shark Conservancy, Two Oceans Aquarium Education Foundation, Two Oceans Aquarium Trust, UCT, UKZN, uShaka Seaworld, Wildlife Conservation Society, WILDTRUST

METRICS

Number of fixed array stations managed & operational = 94
Number of animals tagged = 153
Number of species being tracked = 41
Number of researchers (& institutions) benefitting = 41
Number of students using ATAP = 13

Acoustic telemetry is arguably the most popular tool currently used by researchers globally to determine the movements of aquatic animals. The popularity of this tool has led to the development of large-scale networks across the globe, including South Africa's Acoustic Tracking Array Platform (ATAP). The ATAP is an established research infrastructure comprising a nationwide network of acoustic receivers. This platform is collaborative in nature, whereby researchers using acoustic telemetry to study the movements and migrations of aquatic species, tag and release animals. The receivers then record the signals the tags release, allowing researchers to piece together the movements of individual animals, providing information on the

species in general; these data are freely available to the tag owners. This information is crucial not only for advancing knowledge on the movements of study species, but should be incorporated into management plans, ultimately having a positive impact on current fishery laws and policy. Movement data can shed light on biologically or ecologically significant areas for certain species, allowing the incorporation of these areas into spatial management planning, ultimately protecting a suite of species occupying these areas. Through this, the data collected by the platform have a positive, but indirect, impact on the health and wellbeing of impoverished people living along the coast, whereby increased protection of important fishery species results

A grey reef shark being released along the southern KZN coastline, after being tagged by Dr Ryan Daly.





in an increase in numbers, leading to better fishing opportunities, etc. This will have a positive impact on commerce and the economy through the sale of caught fish.

Context and Impact

The concept of the Blue Economy, whose origins are specifically linked to the United Nation's Sustainable Development Goal (SDG) 14: Life below water, has been gaining significant traction over the past decade. The overarching aim is to improve human well-being and social equity through the sustainable use of aquatic resources for economic growth, while maintaining ecosystem health. While examples of the successful application of this concept exist elsewhere in the world (e.g. European Atlantic shelf seas, and China), African examples are lacking. Because many African countries and their people are severely impoverished, marine resources are heavily targeted, with many stocks being harvested unsustainably. In order to alleviate poverty and promote socio-economic growth, however, fisheries must be managed sustainably.

The African Blue Economy Strategy, developed in 2018, has goals related to sustainable use and the SDGs, including the concept of 'ocean stewardship', which encompasses components of care, agency and knowledge. The knowledge dimension refers to the basic information and understanding about a species, habitat, or other resources being stewarded, which is crucial for the development of management tools, such as Marine Protected Areas (MPAs). In order to determine whether MPAs will protect vulnerable and important fishery species, information on where and when the species moves is critical.

Acoustic telemetry provides information on various aspects of animal movement, including residency and site affinity, home range size, seasonal migratory behaviours and habitat connectivity. The Acoustic Tracking Array Platform (ATAP) - a nationwide network of acoustic receivers deployed along the South African coastline since 2011 - is currently the only network of its kind on the African continent, and represents a significant example of the successful implementation of ocean stewardship principles that can directly contribute to sustainable resource management. The documentation and assessment of the impact of telemetry research is largely lacking; however, in South Africa, this is being realised, with movement data being incorporated in marine spatial planning efforts. This includes a published systematic conservation plan for sharks and rays in South Africa, driven by the WILDOCEANS Programme, which aims to protect threatened and endemic sharks and rays. An ongoing project on dusky kob, *Argyrosomus japonicus*, in the Breede Estuary is also yielding important information which can be used to protect this last population stronghold in the country. These data will be incorporated into an updated management plan for this species in the Breede Estuary and the adjacent De Hoop MPA. Together, the data collected from these projects will have a positive impact on the law, where amendments to existing legislation will improve management of the species. The environment in these areas will be positively impacted by the additional protection provided by changes to management interventions.

While not directly measurable over a short period of time, the data collected by the ATAP will have

positive impacts on the coastal environment, the economy, and the health and wellbeing of coastal communities or people relying on these environments for their livelihoods. Incorporating these data into the development of or existing management plans will see an increase in numbers of important fishery species, leading to better fishing opportunities, an increase in revenue (commerce and the economy) due to fish sales, and ultimately an improvement in the wellbeing and health of individuals.

Measurable outcomes include an increase in the total number of tagged animals monitored on the nationwide network, a record number (50+) of compiled data reports which are used for research projects, student theses and for funding purposes, and continued successful marketing of the ATAP via various media and platforms.

From a capacity development perspective, the

ATAP is dedicated to education, outreach and awareness

through various platforms (e.g. social media, public talks, conferences, etc.) to ensure that dissemination of knowledge is as transparent, broad and impactful as possible.

This is particularly important when it comes to changes in existing management strategies, for example, declaring MPAs in popular fishing areas or reductions in size and bag limits, which, while having a positive impact on fishery resources, can negatively impact people. The ATAP makes continuous efforts to engage actively with the public, positively impacting public participation.

The ATAP, together with NRF-SAIAB's Marine Imagery Research Platform (MARIP), also ran the ever-popular Summer School in December 2022, which was attended by ten enthusiastic undergraduate and postgraduate students. This provides an opportunity for the students to get some hands-on experience, and potentially take their studies further with NRF-SAIAB projects. ATAP personnel were also directly involved with the supervision of eight postgraduate students, with this number anticipated to increase in 2023.



Summer School 2022 attendees, with ATAP staff and students, on the banks of the Kowie Estuary, Eastern Cape. From left: Enrica van Rensburg; NRF_SAIAB PhD student, Dinah Mukhari; ATAP Instrument Technician, Matt Parkinson; Summaya Dube, Nombuso Themba, Kedibone Mathaba and NRF-SAIAB Communications Intern, Andisile Klaas.

Geophysics and Mapping Platform (GeMAP)

DR ERROL WILES
INSTRUMENT SCIENTIST &
GEMAP MANAGER

PLATFORM USERS
 CGS, CORDIO, NMU, NRF-SAIAB, UCT, UKZN,
 University of Stirling, WCT, RU

Currently, we know more about the surface of the Moon and Mars than we do about Earth's seabed.

How do you manage and optimise the oceans if so little is known about them? This gap in knowledge has been recognised. Globally, the drive to responsibly manage the marine space is accelerating. Various strategies and frameworks exist (Agenda 2063; Africa Blue Economy Strategy 2019; 2030 Agenda; Seabed 2030; Ocean Decade) to enhance sustainable use of marine resources towards improving quality of life. Acquisition of data, innovative thinking and techniques, and generation of knowledge is key to support these national and international initiatives.

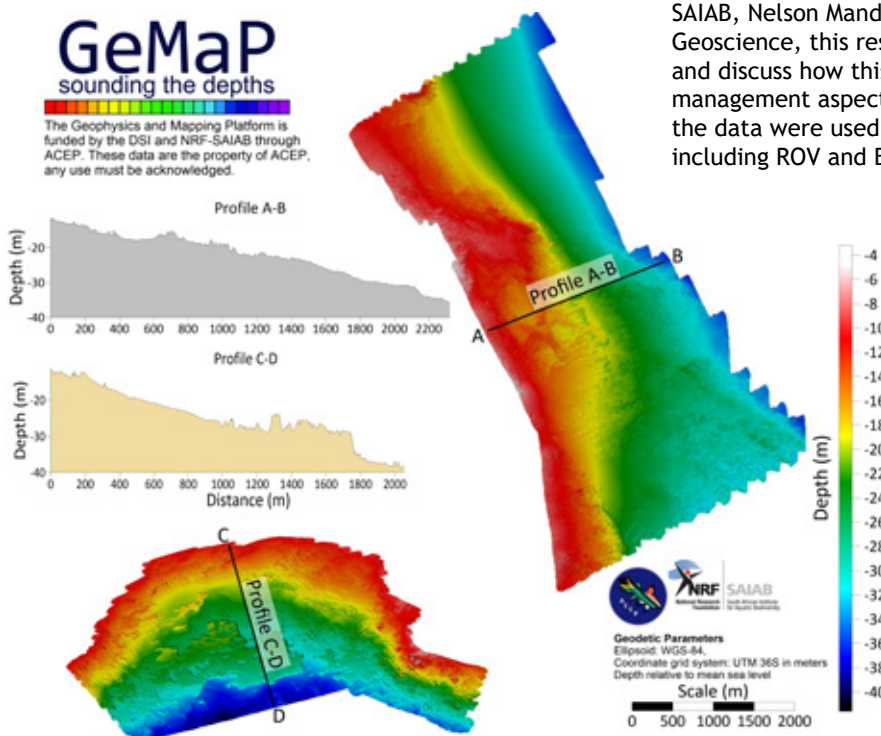
High-resolution multibeam bathymetry data describe the depth, shape and character of the seabed; the foundation of marine systems from polymetallic nodules to biotic communities and habitat. Despite being fundamental to ocean ecosystems, seabed bathymetry is poorly constrained, particularly within South Africa's exclusive economic zone. The NRF-SAIAB Geophysics

and Mapping Platform (GeMAP) is addressing data/knowledge/skills scarcity through project-based data acquisition, research, and capacity development. This is essential if South Africa is to develop sustainable use strategies for the national Blue Economy (including marine spatial planning) while contributing to greater continental and international strategic goals. Contributions are achieved through collaborative research and provision of infrastructure to collect foundational datasets.

Context and Impact

In 2022, the GeMAP supported two major projects (ACEP SMART ZONES MPA and Seascapes), alongside short-term projects. The ACEP SMART ZONES MPA project aims to generate a baseline to facilitate future assessments of MPA management zone effectiveness, and to achieve MPA management objectives.

Six hydrographic surveys were completed for ACEP SMART ZONES MPA, located at sites within the uThukela Marine Protected Area (MPA), which covered strategic biological areas of interest between 40 and 100 m depth, hitherto poorly constrained by high-resolution multibeam bathymetry data. Approximately 100 km² of data were collected using the ACEP's coastal research vessel *uKwabelana*. Data contributed directly to a PhD project, led by Mr Thamsanqa Wanda, aimed at defining the seabed character at selected sites between Durban and Richards Bay. Drawing on skills from within NRF-SAIAB, Nelson Mandela University and the Council for Geoscience, this research will classify geological habitat and discuss how this translates into biological and management aspects of the Blue Economy. In addition, the data were used to plan biological sampling efforts, including ROV and BRUV deployment sites.



Multibeam bathymetry data are used to create 3D digital models of the seafloor. These data from Cape Recife form part of the Seascapes Project in which Prof. Nicola James and her team investigate nearshore environments. Various seabed features are visible, including high-relief reef, and unconsolidated sediment. Profiles A-B and C-D illustrate just how rugged the nearshore bathymetry is.



The Seascapes project aims to i) map and model seascape spatial structure; ii) study the impact of climate change in seascapes, and iii) assess connectivity of fish within nursery seascapes and between shallow nursery seascapes and deeper adult habitat. GeMAP was mobilised on SMCRI's coastal research vessel *Observer* in the third quarter of 2022 when depths of 30 to 10 metres were targeted during surveys, and over 45 km² of new data were collected. The Seascapes project represented the first use of GeMAP's multibeam echosounder on *Observer*. The vessel proved to be an excellent survey platform and holds great potential for future work in the region. This is exciting as Algoa Bay has a long track record of biological research and marine spatial planning efforts which can now be coupled with multibeam bathymetry data in the region.

Data collected by GeMAP in Cape St Francis Bay has been shared with stakeholders from the local community, who are investigating the significant erosion of sediment from local beaches which has impacted coastal properties and tourism with knock-on implications for the local economy. Interested parties are looking to develop solutions which mitigate coastal erosion and reverse the negative impacts experienced to date.

Furthermore, GeMAP acquired data for the University of KwaZulu-Natal and the University of Zululand. These surveys took no longer than a day at sea to obtain the

necessary bathymetry data, illustrating the rapidity with which data can be provided to focused projects. These projects are anticipated to

contribute towards understanding anthropogenic impacts on biodiversity and ecosystem health. Both topics are integral to the Blue Economy and the sustainable use of marine resources.

Negative impacts on biodiversity and ecosystem health would have dire implications for users, particularly in fisheries (subsistence and recreational) and on tourism. Furthermore, in-house training of marine technicians, summer schools in KwaZulu-Natal and exposure of students to the GeMAP is building capacity and familiarity with multibeam bathymetry data.



The RV Observer from which GeMAP's multibeam echosounder is deployed.



Marine Remote Imagery Platform (MARIP)

DR ANTHONY BERNARD
INSTRUMENT SCIENTIST &
MARIP MANAGER

PLATFORM USERS

MMF, NEKTON Foundation, NMU, NNF, NRF-SAIAB, RU, SANBI, UCT, WCS, Wild Oceans

METRICS

Stereo-BRUV samples collected = 300
 ROV dives completed = 133
 Species observations uploaded = 23 600
 Projects supported = 12
 Field trips conducted = 8
 Datasets shared = 3

In underwater environments, responsible research on the status, structure & functioning of ecosystems and living resources is challenging, and limited by access to suitable technologies.

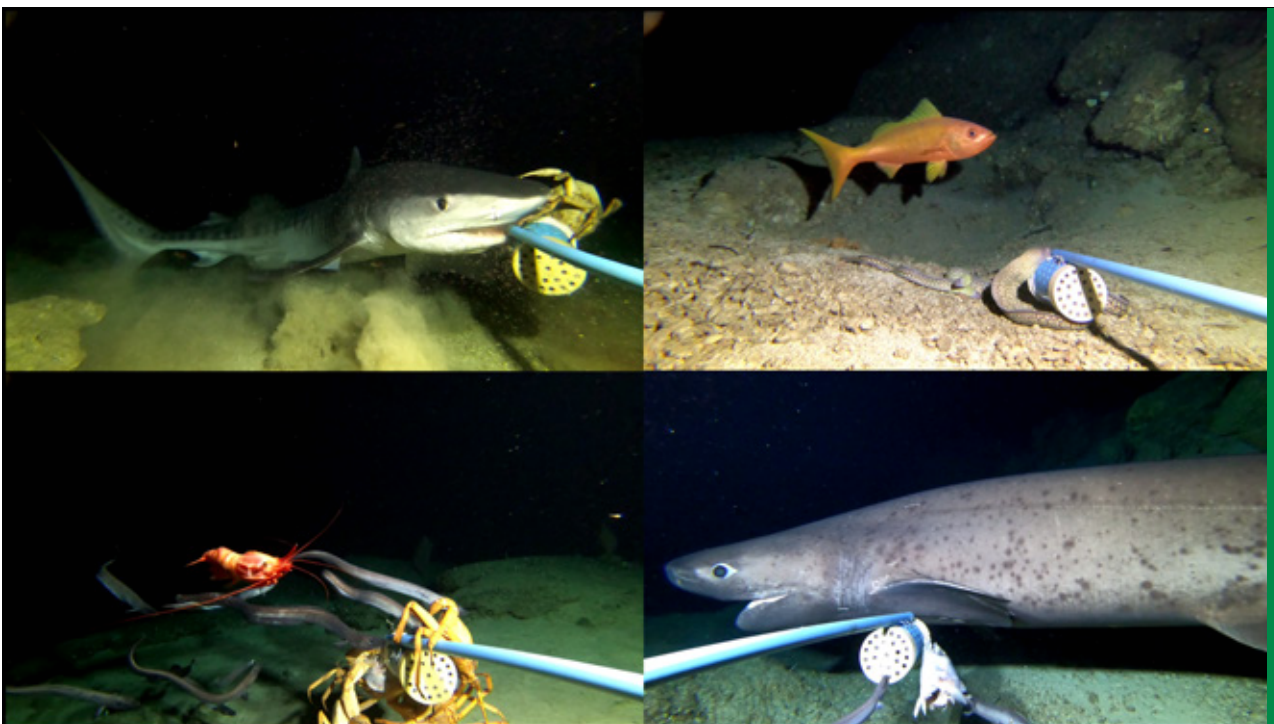
This research is nevertheless essential to support sustainable utilisation and effective management of important ecosystem services. The Marine Remote Imagery Platform (MARIP) addresses this challenge by

providing researchers from South Africa, and the broader region, access to advanced underwater imaging equipment

that can be used to conduct exploratory and quantitative surveys of benthic, demersal and pelagic marine biota from the shallow subtidal down to a depth of 1500 m.

Infrastructure provided by MARIP includes an ROV, multi-imaging drop cameras, and a broad variety of stereo-video camera systems, including tethered and untethered stereo-BRUVs, pelagic stereo-BRUVs and a diver-operated stereo-video system. These are ideally suited to be operated off NRF-SAIAB's coastal crafts, which enable research up to 40 NM off South Africa's coastline.

The platform includes an extensive suite of computing systems for processing the imagery data, a large-scale imagery management facility dedicated to managing and sharing data, along with a team of video analysts trained to facilitate annotation and data analysis. The MARIP is the largest platform of its kind in southern Africa and provides our scientists unprecedented access to research



Examples of the seafloor life observed with the stereo-BRUVs landers between 300 and 900 m deep in the Maldives. Tiger and sixgill sharks were the common apex carnivores while deep-water snappers and moray eels, and macroinvertebrates and cutthroat eels were the common mesopredators and scavengers respectively. Photo credit: © Nekton & NRF-SAIAB.



opportunities to empower research that advances knowledge generation and promotes sustainable management practices.

Context and Impact

In 2022, the MARIP supported research activities carried out by all four of the supported ACEP projects: the MARIP ROV conducted ecosystem mapping surveys and specimen collections for the Deep Connections, Agulhas Bank Connections and SMART Zone project. A baseline demersal fish assessment was carried out for the SMART Zone project with the stereo-BRUVs, while existing stereo-BRUVs datasets were provided to the SALPA project to

determine if there are differences in foraging behaviours when exposed to natural physiological stressors.

MARIP is extensively used by NRF-SAIAB scientists within two broad applied disciplines, methodologies and environmental management: **Methodological research** aims to better understand the costs and benefits of different research methods and undertake optimisation to improve their effectiveness; **Environmental management research**, carried out by NRF-SAIAB with MARIP infrastructure, focusses on advancing

our understanding of the structure, functioning and distribution of marine communities and ecosystems, the effects of anthropogenic pressures and climate change, and how current management measures are mitigating these pressures.

MARIP provides research support to numerous independent South African and international research projects on an annual basis. The extent of the support varies, based on the specific project's needs from basic training and equipment provision, to full logistical and research support to address research questions. MARIP also provides access to existing datasets, video analysts to assist with processing of imagery samples, and long-term support to securely manage imagery samples.

In South Africa, MARIP has provided research support to the WILDOCEANS Programme on numerous marine projects that aim to support and improve the management of Marine Protected Areas and of elasmobranchs. Regionally, MARIP provided video annotation and data management support to the Wildlife Conservation Society's project, which will improve the Conservation Status of Sharks and Rays in the Southwest Indian Ocean. Similarly, MARIP provided infrastructure, expertise and training to the Namibian Nature Foundation to enable assessments of sharks and rays in the Namibian Islands MPA. Lastly, MARIP provided extensive support to the NEKTON Foundation and the Maldivian Marine Research Institute for a research project that aims to support MPA promulgation by implementing the first systematic survey and sampling of the Maldives from the surface to 1000 metre depths.



The Seaeeye Falcon ROV, a critical component of the MARIP.



Collections Platform

NKOSINATHI MAZUNGULA
COLLECTIONS MANAGER

ROGER BILLS
SENIOR CURATOR

PLATFORM USERS

Botswana Wild Bird Trust, FAO, Institute for Marine Research, Norway. Iziko Museums of South Africa, National Geographic Okavango Wilderness Project, NRF-SAIAB, Pennsylvania State University, USA, RU, SU, University of Liège, Belgium

METRICS

Number of specimens catalogued & deposited in the NFC = 1453
Number of tissue samples catalogued & deposited in the Biobank = 5094
Specimen loans & gift for national research = 1828
Tissue sample loans & gifts for national research = 593

The NRF-SAIAB's Collections Platform, housing the National Fish Collection (NFC), is not only renowned for having one of

the most extensive wet collections in the southern hemisphere, but it also possesses the largest number of southern African fish specimens.

The Collection covers a diverse range of specimens, including amphibians, tunicates, cephalopods, and diatoms, and continues to expand, providing students, interns, scholars, and researchers from various parts of Africa and the world with ample opportunity to carry out their research.

Besides research, the Collection also serves an educational purpose, catering to students from primary school level to postgraduate university courses, and the general public. It also functions as a training resource for managers and conservation officers, providing them with knowledge about fishes and aquatic biodiversity in South Africa and neighbouring countries.

The specimen data can be accessed and downloaded via the Global Biodiversity Information Facility (GBIF), which facilitates information sharing and collaboration among researchers worldwide. The specimens and associated data have played a crucial role in several projects, including the Topotype, REFRESH, Barcode of Wildlife, and the IUCN red list of threatened species, contributing to government conservation programmes and research with immediate impact.

Context and Impact

In addition to its research and educational contributions, the NRF-SAIAB's Collections Platform plays a crucial role in addressing equity and transformation challenges in scientific staff by assisting to provide a pipeline of postgraduates as a model for other institutions. This resource can be used by other institutions to

create opportunities for underrepresented groups and promotes principles such as equity, diversity and inclusion (EDI), which are foundational research skills for effective advancement of science. By creating a more inclusive and diverse scientific community, we can ensure that research and conservation efforts are more representative and effective in addressing the challenges facing our planet.

In 2022, Collections platform staff actively participated with an exhibition at the National Science Festival, Scifest Africa. Participation in science engagement events, such as Scifest Africa, provide a valuable opportunity to engage with the public, showcase the Collection's specimens and research, and inspire the next generation of scientists and conservationists.

The National Fish Collection team conducted multiple tours of the facilities, providing visitors with a chance to learn about the Collection's history, scope, and significance, as well as view some specimens up close. As part of their marine guiding course, four international students from the Ulovane Environmental Training also received a tour of the Collection. These tours play a

crucial role in raising awareness about biodiversity conservation and the contribution of Natural History collections to research, education, and outreach.

St Andrew's College students also toured the facility, witnessing the behind-the-scenes efforts involved in preserving and studying specimens, a valuable experience for young learners.

The Barcode of Wildlife Project at NRF-SAIAB was restarted in 2022. The biobank auditing process has helped the team assess the previous work done on the project, including cataloguing and sequencing of



samples. The project aims to create a reference library of DNA barcodes for a wide range of Southern African animal species,

facilitating their identification and contributing to biodiversity research & conservation efforts.

The project will contribute to enhancing the quality and quantity of DNA barcode data available for Southern African fauna, which will benefit several practitioners, including researchers, conservationists, and policy makers.

Dr Franz Uiblein from the Institute of Marine Research, Norway, was the first international research visitor to the NRF-SAIAB Collections, post-COVID. He focused on updating the NRF-SAIAB goatfish collection. He also worked on a group of several species known as the *Upeneus sulphureus* group, which he plans to establish as a new species, through collaborations with colleagues from the United States, Japan, Denmark, Australia, and France.

During his visit, Dr Marek Lipinski was able to assist with sorting the cephalopod collection. Cephalopods are a fascinating group of animals and having a well-organized collection can be immensely helpful for researchers and educators alike.

Prof. Jay Stauffer from Penn State University worked on uncatalogued Lake Malawi samples. On an initial assessment, there are around 200 new lots of cichlids to be catalogued, including several new species that Prof. Stauffer will describe.

Mrs Erica Tovela from the Maputo Museum of Natural History visited the platform to compile data records and images for a book on the freshwater fishes of Mozambique. This project is in collaboration with MRAC scientists, as well as Dr Albert Chakona and Roger Bills.

The Platform underwent an external Natural Science Collection Facility (NSCF) review by the Department of Science and Innovation (DSI). The review included a presentation by NRF-SAIAB Managing Director, Dr Angus Paterson, Biodiversity Information Manager, Dr Willem Coetzee, and Collections Manager, Mr Nkosinathi Mazungula. This review provided an opportunity to showcase the strengths of NRF-SAIAB's collections and research capabilities, as well as receive valuable feedback from the DSI on areas for improvement and future growth of the Collections Platform.



PhD student, Yonela Sithole, working on her samples in the Collection Management Centre.



Margaret Smith Library

MADITABA MELTAF

SENIOR LIBRARIAN

PLATFORM USERS

Fisheries Library, Kenya Marine and Fisheries Research Institute, RU library, RU, Department of Ichthyology & Fisheries Science, University of Basel, Switzerland

METRICS

Books circulated = 710

Articles supplied = 628

New books = 88

Open Access articles on Web Of Science = 57%

The Margaret Smith Library

operates as a strategic, specialised platform providing valuable resources shared with the Rhodes University Library. As part of the Rhodes University community, the postgraduate students housed at NRF-SAIAB have equal access to the University E-learning Resources. The Margaret Smith Library also plays a major role as the primary library for the Rhodes University Department of Ichthyology and Fisheries Science (DIFS). Its literature collection is specialised and focused on aquatic subjects such as ichthyology, aquaculture, and fisheries. The library prioritises relevance when building and updating its collection, ensuring that it meets the specific needs of its primary users: specialists in the aquatic sciences. This approach has resulted in high circulation of books and positive user-satisfaction surveys. The library also actively engages in digitisation projects, making literature produced at NRF-SAIAB more accessible.

Context and Impact

With its user-centric approach, user satisfaction is a key element of the success of the Margaret Smith Library. To continuously enhance service provision, usage and engagement, a user-satisfaction survey was sent

out in 2022 to all users and stakeholders. The users of the Margaret Smith Library include students and staff affiliated with the DIFS at Rhodes University, as well as the staff and students of NRF-SAIAB, and Honorary Research Associates. Additionally, the library caters for the international community seeking access to fish images and archival materials. The survey was aimed at identifying strengths and weaknesses of the Margaret Smith Library, with regard to customer service and library infrastructure. The library users indicated a high level of satisfaction with the customer service of the Margaret Smith Library, as well as its literature collection and e-resources.

The Margaret Smith Library administers the publication output of NRF-SAIAB, and in 2022, 142 ISI-rated papers from 2020 were processed and submitted for subsidy claims through the NRF's Research and Innovation Reward Programme (RIRP), generating an award of R3 933 700 to NRF-SAIAB.

The Senior Librarian, Ms Maditaba Meltaf, organises annual training sessions for NRF-SAIAB interns and students as well as for undergraduates and postgraduates at the DIFS and broader Rhodes University. Additionally, training is done on an ad hoc basis on request. Communication Intern, Andisile Klaas, assisted the Senior Librarian with library duties such as circulation loans, shelving, managing the NRF-SAIAB library Twitter account and updating the in-house noticeboard showcasing current publications and highlighting NRF-SAIAB authors. PhD candidate, Sipehele Dyantyi, provided additional support with stocktaking journals and alphabetically listing and checking journal availability on OPAC, the Rhodes University Library online catalogue.

Digitisation and the Open Access movement remain central pillars of the Margaret Smith Library to help increase dissemination, access and utilisation of information hosted by this platform. The 2019 volume, *Smithiana Monograph, No. 4: Fishes of Southern African Estuaries: From Species to Systems* (by A.K. Whitfield), was digitised and uploaded to the Biodiversity Heritage Library (BHL) (<https://www.biodiversitylibrary.org/page/61837045#page/258/mode/1up>) and to the Rhodes University Library Repository Digital Commons (RUL Vital SEALS Repository) (<http://hdl.handle.net/10962/97933>). The five volumes of *The Coastal Fishes of the Western Indian Ocean* were also catalogued on the Rhodes University Library system and uploaded to Vital SEALS Repository. This set of volumes has attracted 2282 Hits, 2793 Visitors and 990 Downloads on the repository.



Sipehele Dyantyi (PhD student) assisting in the Margaret Smith Library, sorting and stocktaking journals.

TRANSFORM

Human Capital
Development



ACEP Phuhlisa Human Capital Development Programme

GARTH VAN HEERDEN
TRANSFORMATION
MANAGER

PLATFORM USERS
UFH, UNIZUL, UWC, WSU

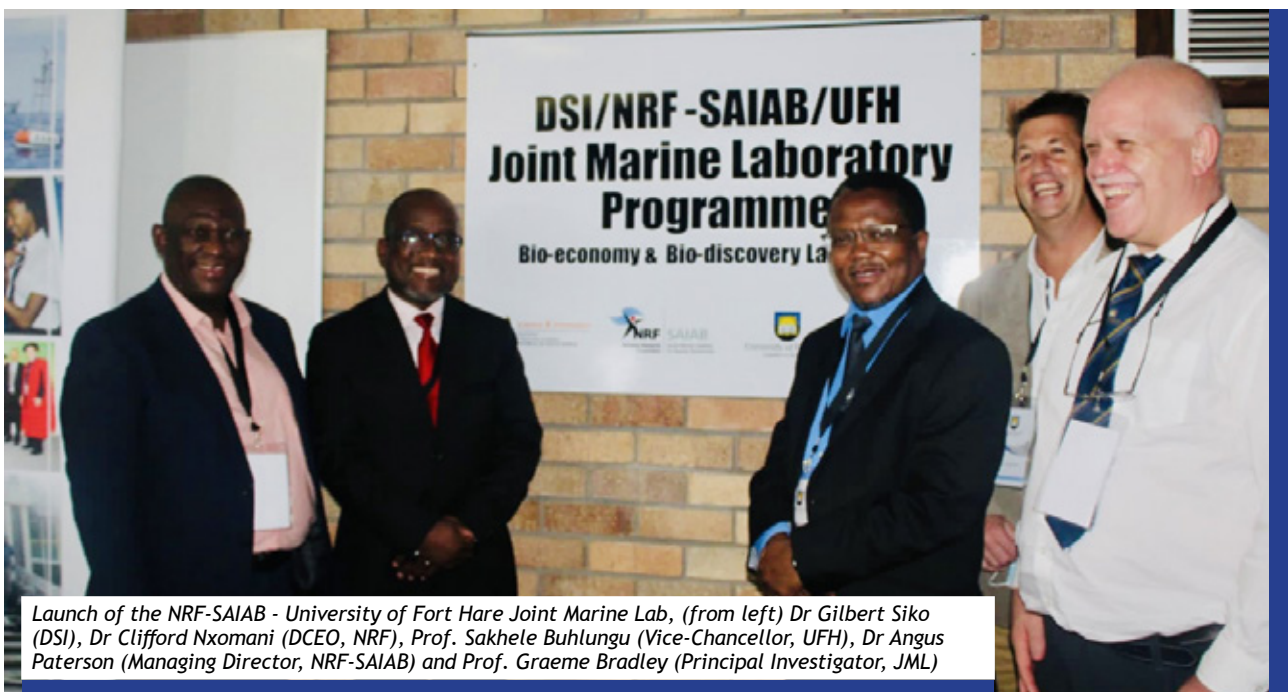
METRICS

Students currently receiving support through
ACEP Phuhlisa = 64
Supervisors = 19
HDIs represented = 4
Joint Marine laboratories = 3

The ACEP Phuhlisa Programme, in collaboration with four Historically Disadvantaged Institutions in South Africa, the Universities of Fort Hare, Zululand, the Western Cape, & Walter Sisulu University, is a strategic DSI (Department of Science & Innovation) transformation initiative.

One of the key aspects of the initiative is the ACEP (African Coelacanth Ecosystem Programme) Open Call, which provides access to National Facility research platforms such as offshore research vessels, skippers, 4X4 vehicles, estuary boats, dive teams, and submersible ROVs. The ACEP programme enables researchers from HDIs to utilise resources that were previously only available to scientists at research-intensive universities. This opportunity not only promotes equitable access to research infrastructure, but also empowers researchers from historically disadvantaged backgrounds to make meaningful contributions to the field of marine science.

Financial assistance is also provided to researchers and students in the form of research funding and study bursaries. These resources enable researchers to conduct their studies and students to pursue their education, further bridging the gap caused by disadvantages they may have faced. Additionally, customised training courses are offered to help students develop essential skills such as academic writing and presentation, addressing the challenges arising from disadvantaged backgrounds. Supervisors and postgraduate students are



Launch of the NRF-SAIAB - University of Fort Hare Joint Marine Lab, (from left) Dr Gilbert Siko (DSI), Dr Clifford Nxomani (DCEO, NRF), Prof. Sakhele Buhlungu (Vice-Chancellor, UFH), Dr Angus Paterson (Managing Director, NRF-SAIAB) and Prof. Graeme Bradley (Principal Investigator, JML)

provided with academic and professional development opportunities, including training courses for skills such as swimming, driving, boat skippering, diving, and first aid.

Context and Impact

The National System of Innovation (NSI) has set a target for South Africa to increase its research output to over 1% of global research output by 2030. This will take more than merely increasing research funding. It will require developing the country's Human Capital resources. Currently, most of South Africa's research output is produced by a few universities and research institutions, the so-called 'research-intensive' universities. Furthermore, marine science is currently primarily conducted by historically white, previously advantaged universities and the postgraduate schools within these institutions do not reflect the true demography of South Africa. After discussions with the NRF and the DST (now DSI), it was decided that, in addition to the Open Research Call quotas, a specific and ring-fenced tool was required to

ensure black South African postgraduates are trained within the marine sector and that marine science is more deeply entrenched at HDIs.

The ACEP Phuhlisa programme has been planned and designed around key impediments which limit entrance or participation in marine science, as articulated by HDI researchers and students.

Through the ACEP Phuhlisa Programme, the research support provided by NRF-SAIAB plays a crucial role in enhancing research and supervisory capabilities at the partner universities. This collaboration ensures the graduation of an increasing number of black and female South African postgraduates, contributing to a more

diverse and inclusive research community in the marine sector.

Phuhlisa student numbers have increased steadily to reach a total of 107 in 2020, with MSc students, making three or four years to complete their studies, making up the bulk of students. Student numbers for 2021 and 2022 have been affected by the new NRF student funding model, as well as Phuhlisa placing a cap on the number of students. The number of students in 2022 was only 64, down from 70 in 2021.

The next phase of the Phuhlisa programme involves the development the DSI/NRF-SAIAB Joint Marine Laboratories Programme (JMLP) at the HDI campuses. The objective of the JMLP is to twin expertise of the four partner universities with expertise of a DSI/NRF National Facility, that is, NRF-SAIAB. These laboratories continue to build on existing research and laboratory activities at the universities and ensure access by university staff to ACEP infrastructure, for example, coastal vessels and research equipment. The laboratories are jointly co-ordinated by the partner universities and NRF-SAIAB.

The DSI/NRF JMLP aims to address key marine, social, and economic opportunities and challenges facing South Africans, and also includes development of technical skills to co-manage these joint research platforms. Four JMLs have been planned, with the following progress by 2022:

UWC - Microplastics (Principal Investigator: Prof. Rajkaran): The refurbishment of the laboratory was completed.

UNIZULU - Marine ecotoxicology (Principal Investigator: Dr Masikane): This JML was officially launched in December 2022.

UFH - Biodiscovery (Principal Investigator: Prof. Bradley): The launch of this JML took place in March 2022.

WSU - Coastal Livelihood and Ecology (Principal Investigator: Dr Dlaza): Plans are in place to build the research station at Lwandile near Mngazana. This JML will receive field equipment including a 4x4 vehicle, an estuary boat, multi-parameter probe, etc.



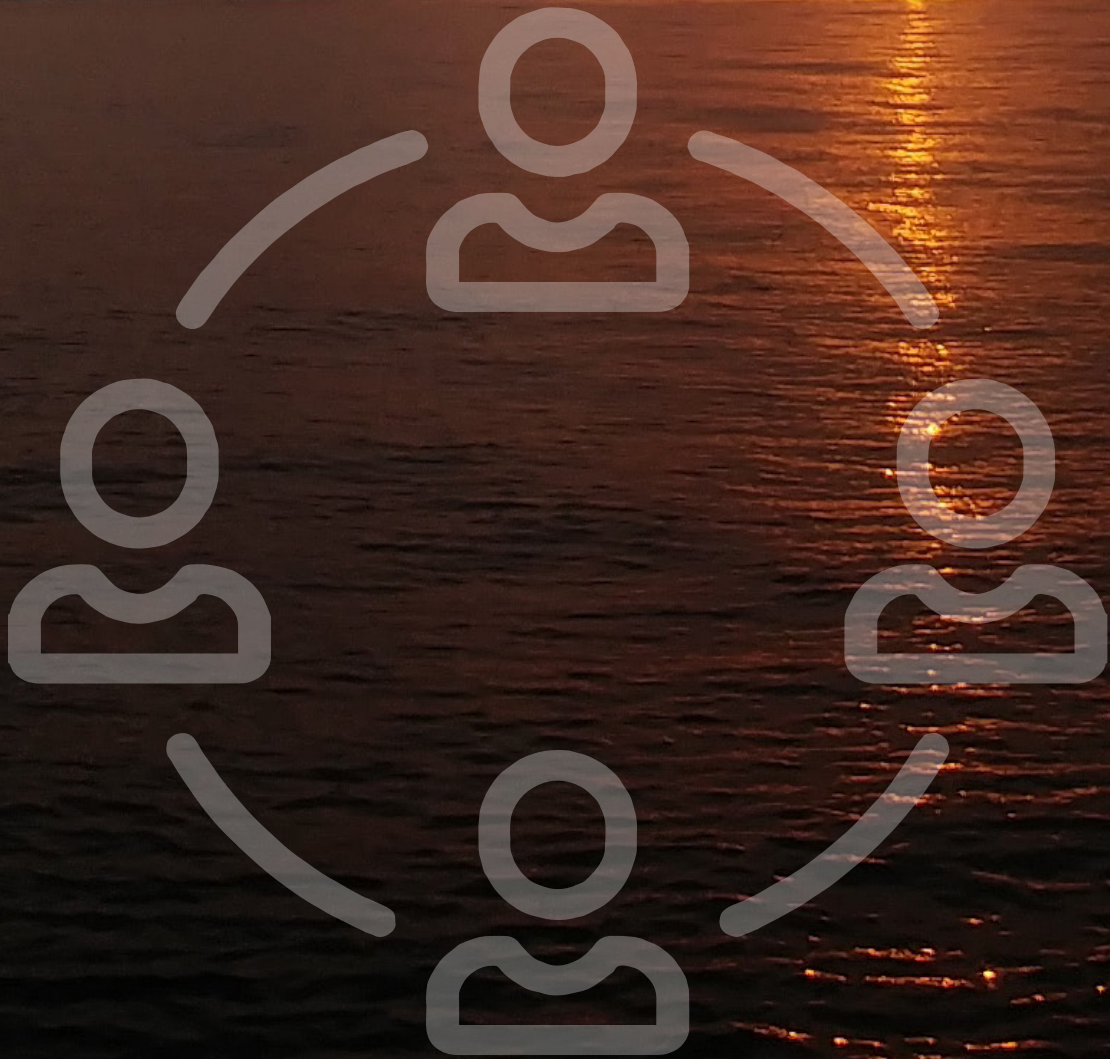
Launch of the NRF-SAIAB - University of the Western Cape Joint Marine Lab. Prof Anusha Rajkaran (Principal Investigator, JML) showing delegates how the spectrometer operates.



Sethu Mnqotho doing the biochemical analysis of mussels and oysters.

NETWORK

Strategic Engagement &
Collaboration



Amphibian diversity and conservation

PROF. LOUIS DU PREEZ
NORTH WEST
UNIVERSITY
NRF-SAIAB HONORARY
RESEARCH ASSOCIATE

TEAM MEMBERS

Louis du Preez; Fortunate Phaka

COLLABORATIONS

University of Perpignan, Auburn University, Belem University, Bristol University, Hasselt University

Research seeking to improve conservation outlook is especially important for this project's focal group, amphibians and reptiles, of which 41% and 21% species, respectively, have been decalred globally threatened by the IUCN. Wildlife-based cultural practice research improves understanding of human activities that impact wildlife (negatively and positively).

Understanding biodiversity's interactions with cultural diversity can therefore increase the effectiveness of conservation planning & improve the balance between social & conservation objectives.

Consideration of cultural practices contributes to Sustainable Development Goals 11, 15 and 16, by promoting conservation planning that is inclusive of previously excluded members of society, while also documenting (and incidentally protecting) cultural practices. Culturally inclusive biodiversity conservation is in line with the Global Biodiversity Framework, which promotes consideration of cultural practices in decision-making. Outputs of research focused on cultural practices informs science-based integrative conservation that is suited for wildlife conservation in culturally diverse landscapes.

Context and Impact

South Africa's traditional cultures have practices that rely on frogs and reptiles and investigating these practices improves knowledge of them as they are part of human activities that impact wildlife both negatively and positively. An increased understanding of such cultural practices that rely on wildlife improves conservation by contributing to social and conservation objectives. Protective practices can also improve conservation by making it contextually appropriate and socially inclusive.

In 2022, surveys in KwaZulu-Natal and Namibia led to the discovery of two as yet unknown frog species which are currently being described. A study of the endangered

long-toed tree frog has been completed, and the number of known localities for the species is being duplicated. The Udzungwa grass frog, known from Tanzania and eastern Zimbabwe, was discovered on the Soutpansberg Mountain range in South Africa. During 2022 the focus was also on rain frogs, with a new species collected in KZN.

Thirteen scientific papers and one book chapter were published in the open literature. A comprehensive book on polystomatid flatworm (frog) parasites of the world was submitted to Springer publishers.



Kloof frog (Natalobatrachus bonebergi), a threatened KwaZulu-Natal endemic species.

Freshwater fish parasite species of South Africa

PROF. NICO SMIT
NORTH WEST
UNIVERSITY
NRF-SAIAB HONORARY
RESEARCH ASSOCIATE

TEAM MEMBERS

Nico Smit, Albert Chakona, Marliese Truter, Lizaan de Necker, Iva Prikrylová, Kerry Hadfield Malherbe, Wilmien Luus-Powell, Anja Erasmus, Wynand Malherbe, Roelof Burger, Dirk Cilliers, Victor Wepener, Ncobile Nkosi, Farina Lindeque

STUDENTS AND INTERNS

Chandre le Roux (MSc), Rudolf Gouws (MSc), Nisa Ayob (PhD)

COLLABORATIONS

UL, CapeNature; NRF-SAIAB, SANBI, UFS

As a water-scarce country, South Africa recognises the

*value of its freshwater,
 not only for the survival
 of mankind, but also
 for social and economic
 development.*

The freshwater systems of South Africa hold a unique diversity of taxa, especially fishes, but the most recent NBA (2018) confirms that, despite conservation efforts, our fish are still under threat. More importantly, these fishes also serve as hosts to smaller organisms, known as parasites, and the biodiversity of our micro-ecosystems are also at risk.

The threats to the ecological heritage of South Africa may impact cultural, social and economic aspects, including eco-tourism, and international research collaborations that generate income, knowledge and expertise related to our unique aquatic biodiversity. Although parasites themselves may not be a primary focus of conservation efforts, they play a critical role in conserving the host organisms. By gaining knowledge of these tiny organisms, we can use them as indicators of missing ecosystem links and pollution, as well as understand their contribution to energy flow and biomass. Furthermore, their role as control agents, disease vectors and defence mechanisms against other parasitic infections may become apparent as we expand our knowledge. Studying parasitic species can ultimately serve to promote the conservation of host organisms due to the specialisation and co-evolution with their hosts and sensitivity to change in aquatic environments.

This research contributes to the identification of innovative approaches to conserve habitats (in this case the fish hosts) and potentially increase economic benefits through a multi-species conservation approach. By mobilising and updating historical and current knowledge, prioritising poorly explored and critical habitats, and recommending long-term monitoring and informed conservation strategies, this project aligns with South Africa's biodiversity management and species

conservation criteria at a global scale.

Data catalogues and protection status are crucial elements for the optimisation of the conservation of macro- and microfauna in the freshwater ecosystems of South Africa. As part of the microfauna in our aquatic ecosystems, ichthyoparasites contribute to biodiversity, but more importantly, parasites facilitate the complexity of linkages among fauna that live in or use aquatic ecosystems. Further, the study of parasites encompasses an understanding of their ecology, biology and potential as biotags as well as effect indicators where pollutants are a threat to the persistence and overall health of aquatic organisms and ecosystems.

The freshwater ichthyoparasite fauna in South Africa remains largely unknown, resulting in significant knowledge gaps regarding parasite taxonomy and ecology. There is currently no comprehensive, up-to-date atlas available that specifically focuses on the parasite fauna of freshwater fishes in South Africa. In some instances, data are questionable, records are unclear, and the most recent inventory of parasitic species of freshwater fishes was completed in the early 1980s. Information used to identify the National Freshwater Ecosystem Priority Areas (NFEPA) was last published ten years ago and it would seem that parasitic species of freshwater fishes were not included in the assessment. Consequently, this research aims to update and compile species data, create a catalogue, and use DNA barcoding to study the biodiversity of freshwater fish parasites of South Africa. This research assists in facilitating the assessment of species extinction risks, thus

*enabling informed
 conservation decisions
 to mitigate the impacts
 & promote education
 on South Africa's
 biodiversity & ecological
 heritage.*

Context and Impact

Protecting, conserving and advancing awareness of our natural heritage are crucial elements to achieve the objectives set in the United Nations SDGs 10 (NDP2030) and 14 to enhance environmental assets and resources at both national and global scales. The research conducted under the REFRESH project is managed through a multi-institutional partnership (SANBI, North West University, NRF-SAIAB) and aims to advance scientific research and knowledge to provide insights on aquatic species, their current status, distribution and threats. This project aims to improve our understanding of all components that contribute to ecosystem biomass and play essential roles in the complete functioning and links among organisms within the ecosystems of interest.

For the freshwater fish parasitological research component of the project, six National Freshwater Priority Areas (NFEPAs) have been identified, where fish species of high conservation concern occur. The NFEPAs in South Africa serve as freshwater regions that aid in the prevention of freshwater species becoming increasingly threatened, and priority is given to these sanctuaries and the species that inhabit them. There are, however, significant gaps in our knowledge regarding species and diversity, mostly due to a lack of available biogeographic and species record data. Furthermore, an up-to-date atlas for the parasite fauna containing biogeography, ecology, distribution and host ranges specific to South Africa is lacking. The mission of the research initiated in 2022 is to promote and stimulate initiatives that use our unique biodiversity, thereby promoting conservation. Through an interdisciplinary approach, the investigation of hosts and their parasites will inform conservation tools and decision-making for conservation of species at host and associated symbiont levels.

During 2022, the project also provided training to early career researchers and students, equipping them with the necessary skills to conduct and disseminate research findings. Further, the project's findings have been shared through conferences and informative publications reaching broad audiences. Successful collaborations with conservation agency, CapeNature, have been established and interactions with permitting offices involved in species protection have increased awareness.

Lastly, capacity development is ongoing, with three MSc students and one Honours student participating in the data collection and processing from the NFEPAs.

An additional component of the research is the work on schistosomiasis (bilharzia), a neglected tropical disease caused by parasitic trematodes, transmitted to humans through contact with contaminated waterbodies that contain the snail vectors. Schistosomiasis is a serious public health issue in South Africa, affecting at least 4.5 million people annually. Despite early evaluations of the vectors, carried out from the 1950s to 1960s, the current status of the snails and the disease in South Africa is unknown. It is further unclear how environmental and climatic changes, and the presence of invasive species, may alter the distribution of the vectors and, consequently, the disease. It is also not well-known how communities who live in high-risk infection areas deal with this disease and if they are aware of it and the serious health risks associated with it. The aims of this research project are therefore to determine whether the distribution ranges of the snail vectors and parasites of schistosomiasis have expanded, the understanding of this disease by local communities, and how climate change may alter the distribution thereof and change the risk of exposure to people in South Africa.

Once completed, this study will have impacts on the environment through state-of-the-art research that assesses the impacts of invasive species on the natural aquatic biota and the current status of native freshwater snail species. This study also makes use of various models to research how future predicted climate change may alter the distribution of the native freshwater snail species and their associated parasites; hopefully, this will feed into national policies on monitoring and control of invasive species in South Africa and the status of our freshwater ecosystems. This research will have impacts on public policy, law and services as it is funded by the Water Research Commission (WRC) and information gathered will be shared with the WRC, and will also be available for decision- and policy-makers, hence assisting in developing elimination strategies. Results from this study were presented at a national conference in 2022 and as a seminar to international researchers.



Prof. Wynand Malherbe collecting snails which may be carrying schistosomiasis (bilharzia) parasites

Acanthocephalan, commonly known as aspiny-headed worm, found in the body cavity of Sederocypris calidus (Clanwilliam redfin). These worms can be used as indicators of the effect of metal pollution on hosts in aquatic environments.

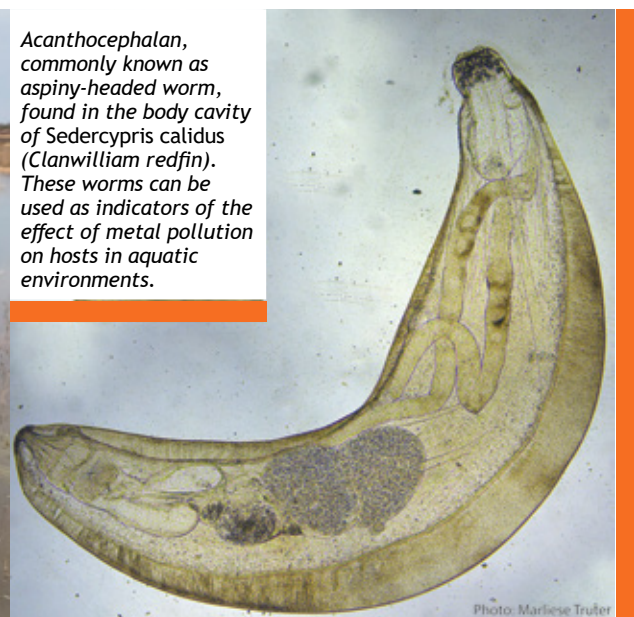


Photo: Mariëse Truter

Nile Tilapia research in Lake Malaŵi

PROF. JAY STAUFFER JR.
PENN STATE UNIVERSITY
NRF-SAIAB HONORARY
RESEARCH ASSOCIATE

TEAM MEMBERS

Jay Stauffer Jr, Paul Skelton, Albert Chakona,
 Joshua Wisor, Denis Tweddle, Roger Bills

Inland freshwater fisheries are a major source of food and economic security for a large proportion of the global population,

particularly for poor rural communities that do not have sufficient food to meet the recommended daily calorie and nutrient intake. Most of the economically valuable fish species, however, for example the chambo (*Oreochromis* spp) in Lake Malawi, face a high risk of extinction due to over-exploitation. These threats are further exacerbated by the invasion of Nile tilapia, *Oreochromis niloticus* in the Lake Malawi catchment, as the potential spread of this species into the lake through escapes from aquaculture facilities could be detrimental to the chambo stocks through hybridisation and competition.

The Nile tilapia, *O. niloticus*, is a cichlid indigenous to the tropical and subtropical parts of eastern and western Africa and is being cultured in the catchment basin of Lake Malawi in Tanzania. The probability of the Nile tilapia dispersing throughout Lake Malawi, once it escapes from the culture facilities, is enhanced by its fast growth rates, large size relative to native

Oreochromis species, and its diverse repertoire of feeding options. Additionally, the success of its invasion has been attributed to high levels of parental care and its ability to produce multiple broods throughout the year. The Nile tilapia was implicated as a key contributor to the collapse of the Lake Victoria indigenous *Oreochromis* fishery. There is, hence, an

urgent need for efforts to prevent the invasion of Nile tilapia into Lake Malawi to protect the lake's unique fish fauna and safeguard human livelihoods.

The 2022 scientific output resulting from this research was published in *Biological Invasions* and highlighted that native fishes which, in recent years, provided 70% of the animal protein consumed in Malawi would be threatened by the colonisation of the Nile tilapia. Should the Nile tilapia become established in Lake Malawi it would i) cause the extirpation of native fishes, ii) hybridise with endemic *Oreochromis* spp., and iii) damage the livelihoods of existing artisanal fishermen.



An artisanal fishing boat at Cape Maclear, Lake Malawi

Fish and Fisheries in Estuaries - A Global Perspective

PROF. ALAN WHITFIELD
NRF-SAIAB CHIEF
SCIENTIST EMERITUS

TEAM MEMBERS

Alan Whitfield, Kenneth Able, Stephen Blaber,
 Mike Elliott

COLLABORATIONS

NRF-SAIAB, Rutgers State University, CSIRO, Hull
 University

The book *Fish & Fisheries in Estuaries - A Global Perspective* brings together the current state of knowledge of estuarine fish in one inclusive two-volume work.

Featuring contributions by more than 50 internationally-recognised researchers, this landmark resource covers fish assemblages and functional groups, recruitment and production in estuaries, feeding ecology and trophic dynamics, fisheries and the conservation of estuarine fish, and much more.

Thirteen in-depth chapters and two method appendices examine major aspects of fish and fisheries in estuaries throughout the world. The text describes the biology of estuarine fish and their connections with estuarine and adjacent marine and freshwater ecosystems, and examines the ways human industrialisation and global events, such as climate change, are impacting both native and non-native species.

Topics include habitat diversity, fish foraging behaviour, ecological engineering tools and models, hazards and risks to estuarine fish and fisheries, and estuarine environmental health. This authoritative reference:

Explores current approaches and future research directions aimed at achieving a balance between exploitation and conservation of estuarine fishes.
 Discusses environmental quality objectives and sustainable management of estuary fisheries.

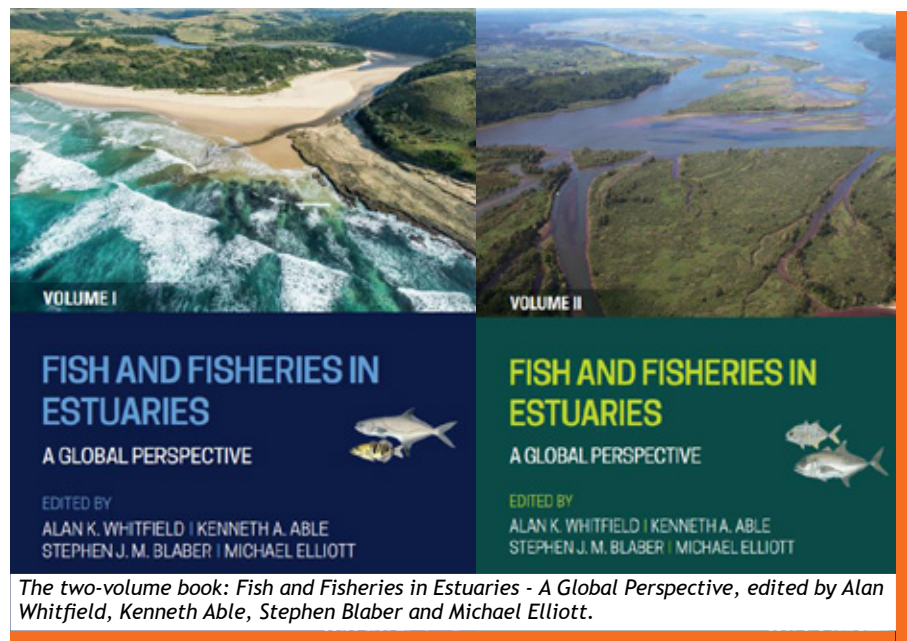
Addresses the impacts of increased human use of resources such as food, space, and water to estuarine fish and fisheries.

Features numerous international case studies of management of fisheries, threatened species, estuarine rehabilitation, reproduction and ontogeny.

Covers study and sampling methods, field equipment, and data processing, analysis, and interpretation.

Context and Impact

This groundbreaking book represents the first comprehensive global synthesis and interpretation of published scientific information on fish and fisheries from estuaries around the world. Its international scope ensures that both developed and developing countries can benefit from the knowledge presented in this book. This book will serve as an invaluable resource for undergraduate and postgraduate students, as well as established scientists and professionals, to access important topics in the field of estuarine ichthyology and coastal fisheries. Accessible in both print and digital formats, it is ideally suited for use in university or institutional environments. The information contained within the book holds significance in addressing important management issues related to estuarine fisheries, the impact of climate and global change on estuaries, conservation efforts aimed at preserving estuarine fish diversity and fisheries resources, as well as the sampling gear and analytical methods available for conducting comprehensive research surveys or studies on fish in estuarine environments.



Genomic and socioeconomic studies conducted to address critical fisheries questions in South Africa and the Western Indian Ocean.

PROF. JESSICA GLASS

UNIVERSITY OF
ALASKA FAIRBANKS

NRF-SAIAB HONORARY
RESEARCH ASSOCIATE

TEAM MEMBERS

Jessica Glass, Wouter Holleman; Gavin Gouws; Bruce Mann; Paul Cowley; Sheena Talma; Pavitray Pillay

COLLABORATIONS

ORI, WWF-SASSI, Brigham Young University, Yale University, U.S. National Human Genome Research Institute

Genomics is a critical component of fisheries management for its application in delineating populations and stocks. In addition, market-based incentives such as sustainable seafood labelling programmes are considered critical drivers of sustainable consumer practices. In combination, these tools are useful for informing both fisheries managers and members of the public.

A combination of genomic and socioeconomic studies was conducted by the research team to address critical fisheries questions in South Africa and the Western Indian Ocean. The work delineated a different species of linefish (*Lethrinus*) that is understudied and found only in South Africa, as well as distinct genetic populations of trevallies in the central Pacific Ocean. Evidence of reduced gene flow between populations of bonefish in Seychelles and Mauritius was also found.

Surveys of fishers in the Seychelles on the

feasibility & support for a market-based sustainable seafood labelling programme,

were conducted. Results from fisher surveys show support for such a programme, but identified several barriers useful for agencies, who may want to implement such a market-based tool, to consider. One such barrier was limited data on the biology of artisanal fishery species, of which the kingfish account for >25% of artisanal catches, highlighting the need for additional biological research.

Context and Impact

Several factors - including biological, economical, and social - contribute to the sustainability of commercial, artisanal, and sport fisheries. Dr Jessica Glass was involved in three projects with NRF-SAIAB collaborators and former students that address these three factors in Western Indian Ocean fisheries.

Dr Glass was part of a Seychellois-led team of international scientists, including former NRF-SAIAB/Rhodes University student, Sheena Talma, which set out

to determine the feasibility of establishing a seafood labelling system in Seychelles and to understand specific considerations that are unique to Small Island Developing States (SIDS).

Seafood labelling systems (e.g., WWF-SASSI) are used worldwide to provide consumers with information on the status of the fish they are eating, enabling them to choose more sustainable options and driving fishers to target more sustainable species. To date however, no sustainable seafood labelling initiative has been established in African SIDS, or in any SIDS globally. The SIDS depend on healthy marine ecosystems, yet these nations are some of the most vulnerable to climate change and over-exploitation of fisheries resources. Small-scale fishery resources are critical for food security and economic livelihoods in SIDS.

Interviews with 33 artisanal fishers were conducted to gauge the level of support for such an initiative and to understand the perceived barriers and potential incentives for implementation. Of the respondents, 64% would like to see a programme implemented, but only 34% thought it would be successful. The barriers mentioned by fishers included concerns over how such an initiative would be regulated and enforced within the industry, the lack of biological information on fishery species, and the lack of control by fishers over species caught. The most frequently perceived benefit was the potential to increase the price of a broader range of species.

In addition to socioeconomics,

genomics is a critical component of fisheries management for its application in delineating distinct populations & stocks.

A team including Dr Glass, ORI scientist Dr Bruce Mann, NRF-SAIAB Honorary Research Associate Wouter Holleman, and former NRF-SAIAB scientist Dr Gavin

Gouws investigated the morphology and genetic differentiation of the popular linefish species, the spangled emperor (*Lethrinus nebulosus*). There was evidence of a different species that is found only in South Africa.

This is important for developing sustainable management practices for the South African linefish fishery,

as the range of the species is now greatly reduced from the Western Indian Ocean to South Africa only.

Dr Glass, NRF-SAIAB scientist Prof. Paul Cowley, Sheena Talma, and American collaborators at Brigham Young University completed population genomic studies on three important sport fishery species: the Western Indian Ocean bonefish (*Albula glossodonta*), the giant kingfish (*Caranx ignobilis*) and the bluefin kingfish (*Caranx melampygus*). We evidenced limited gene flow between Seychelles and Mauritian bonefish, but most populations across the Seychelles remain genetically connected. This

work included generating the first high-quality reference genomes for these three species, which are incredible, fully accessible resources for the global research community. For the kingfish, this work comprised the first global population genomic study on these species, where next-generation techniques (ddRADseq) to sample hundreds of individuals from 13 Indo-Pacific localities were used. Results from this work showed the presence of a genetically distinct population of giant trevally in Hawaii, USA and Kiribati, and a genetically distinct population of bluefin trevally in Hawaii, USA. This work is important for fisheries sustainability because giant trevally are currently considered overfished in Hawaii by the National Oceanic and Atmospheric Administration (NOAA). The genomic evidence pointed to a high degree of connectivity between giant and bluefin kingfish in the Western Indian Ocean; that is, there was no evidence of distinct genetic populations.

The above work was conducted in conjunction with fishery stakeholders, including commercial fly-fishing operators, local collaborators, federal and state agencies, and academic partners. The implications of this work highlight the greater knowledge gained and the impact of combining different fields of science - genomics and socioeconomics - when informing sustainability practices for fisheries.



Handline fishermen off Mahé, Seychelles.

Elasmobranch Research

DR DAVID EBERT
PACIFIC SHARK
RESEARCH CENTRE
NRF-SAIAB HONORARY
RESEARCH ASSOCIATE
& HONORARY CURATOR:
CHONDRICHTHYANS

COLLABORATIONS

David Ebert, Rima Jabado; Rachel Aitchison; Michaela van Staden; Aletta Bester van der Merwe; Joanna Alfaro-Shigueto; Ximena Velez-Zuazo; Adriana Gonzalez Pestana; Will White; Gavin Naylor; Jenny Kemper; Brit Finucci; Marc Dando

As apex and mesopredators, chondrichthyans, which include

sharks, rays & skates, help in maintaining marine food chains, & as such, they serve as key indicators of ocean health.

Dr Ebert is the Honorary Curator of chondrichthyans at NRF-SAIAB and continues to serve on the executive committee as the immediate Past President of the American Elasmobranch Society (AES), as well as on the executive committee for the IUCN Shark Specialist Group.

The major project published in 2022 was the publication of the five-volume *Coastal Fishes of the Western Indian Ocean* and a monograph on the softnose skate genus, *Bathyraja*, from the northeast Pacific. Publications of such large foundational volumes or monographs extend the reach of scientific knowledge, while advancing taxonomy and systematics. These volumes also generally contribute to education and upskilling of experts in this field of knowledge. In addition, nine peer-reviewed journal articles were published. In 2022, one new elasmobranch genus and three new species were described. Dr Ebert attended the Sharks

International Conference in Valencia, Spain in

October 2022, and the Northeast Pacific

Shark Symposium in April 2022. One

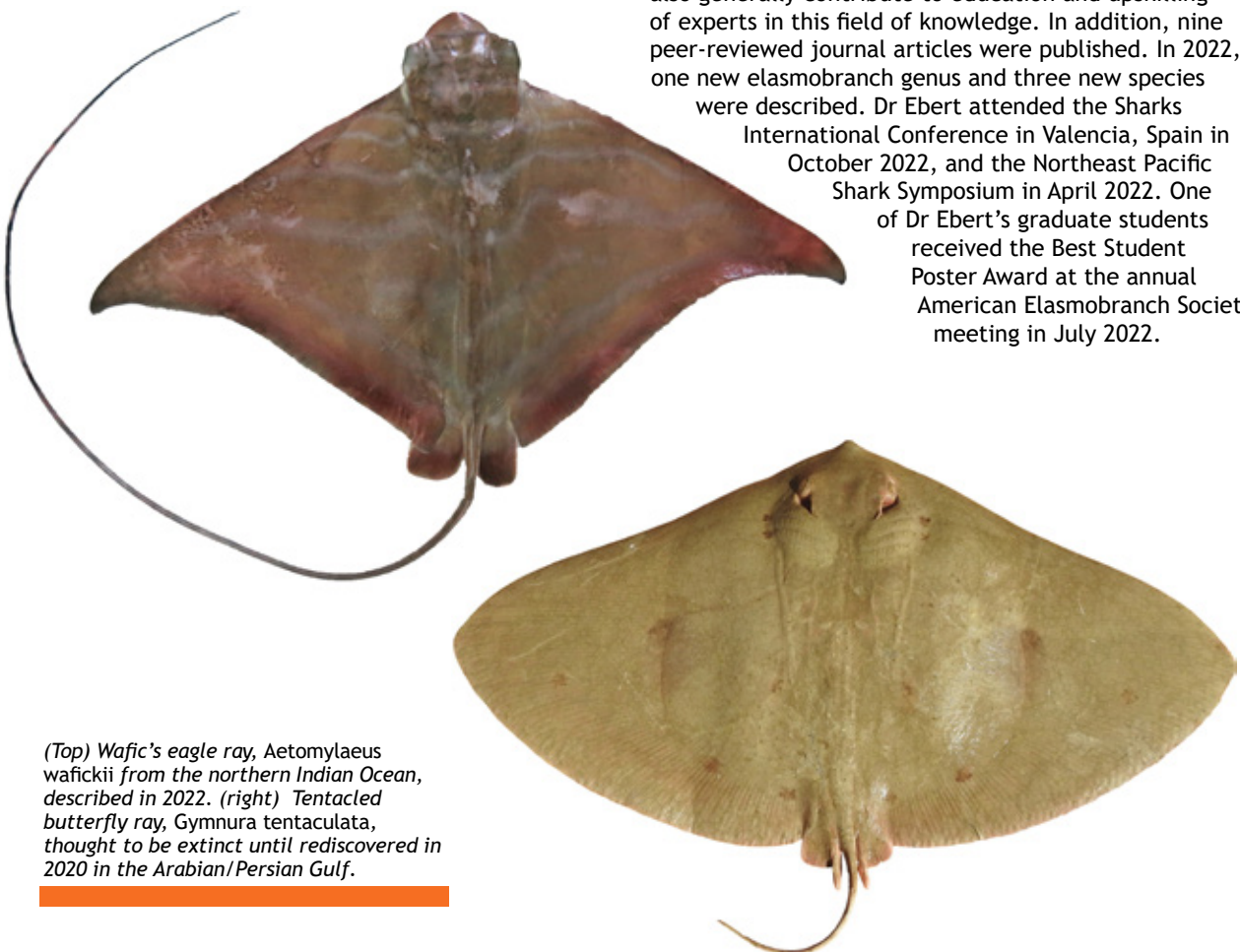
of Dr Ebert's graduate students

received the Best Student

Poster Award at the annual

American Elasmobranch Society

meeting in July 2022.



(Top) Wafic's eagle ray, *Aetomylaeus wafickii* from the northern Indian Ocean, described in 2022. (right) Tentacled butterfly ray, *Gymnura tentaculata*, thought to be extinct until rediscovered in 2020 in the Arabian/Persian Gulf.

Drug discovery

PROF. ROSEMARY DORRINGTON

**DST/NRF SARCHI PROFESSOR:
MARINE NATURAL PRODUCTS
RESEARCH, RHODES
UNIVERSITY**

**NRF-SAIAB HONORARY
RESEARCH ASSOCIATE**

TEAM MEMBERS

Rosemary Dorrington, Tarryn Potts, Roxanne Higgitt, Michelle Isaacs, Jarmo Kalinski, Tarryn Swart, Alexandra's Polyzois, Idris Njanje, Ross-Lynne Gibb, Eric Isemonger, Dele Abdissa, Luthando Madonsela Wakisa Kipandula, Tumi Tsele, Gabriella Solomons, Asisipho Dloboyi, Tshepiso Seshoeshoe

The Marine Natural Products (NPs) research group works across the broad field of marine biodiscovery to

explore the potential of bioactive small molecules as molecular probes for drug development.

Research activities include i) mapping benthic macrofauna diversity in the Agulhas Bioregion; ii) assembling taxonomically identified, curated collections of invertebrates, tunicates and their associated microbiota; iii) generating and screening NPs extract libraries for antimicrobial, anticancer and antiviral activity, and iv) developing multi-“omics” approaches to isolate novel bioactive NPs. While the focus is on drug discovery, the team is also interested in understanding how and why these bioactive secondary metabolites are produced, the

response to a changing environment and how to better understand ecosystem functioning. This is done through a systems approach, integrating genomics and metabolomics with physical and biological oceanography data to identify physical and biological drivers of aquatic ecosystem functioning.

Context and Impact

In 2022, the Marine Natural Products research group celebrated the doctorate graduations of Ross-Lynne Gibb and Eric Isemonger. Dr Gibb used genetic approaches to characterise the Agulhas system microbial communities. The Agulhas Current is an important regulator of climate in southern Africa, influencing growth of the microorganisms at the base of marine food webs that support coastal fisheries. Dr Gibb identified indicator species linked to environmental variability that can be used as early warnings for anthropogenic-induced change.

Dr Isemonger used metagenomics approaches to study the diversity and metabolic potential of living South African stromatolites. Stromatolite fossils are the earliest evidence of cellular life on Earth some 3.4 billion years ago. These layered, rock-like structures are formed by specialised microbial communities by fixing CO₂ that is precipitated in CaCO₃ that can remain unchanged for billions of years. Dr Isemonger discovered that these living rocks may be the most efficient biological carbon sequestration systems on Earth with potential applications in mitigating greenhouse gas emissions.



Collecting sponge specimens in Algoa Bay. Dr Tarryn Swart and Ms Tarryn Potts catalogue and process a specimen on the RV Observer.

Cephalopods

DR MAREK LIPINSKI
NRF-SAIAB HONORARY
RESEARCH ASSOCIATE

TEAM MEMBERS

Marek Lipinski, Robin Leslie, NRF-SAIAB

COLLABORATIONS

Natural History Museum, Danish Natural History Museum

Natural history collections are invaluable knowledge and heritage resources that document historical and modern patterns of biodiversity,

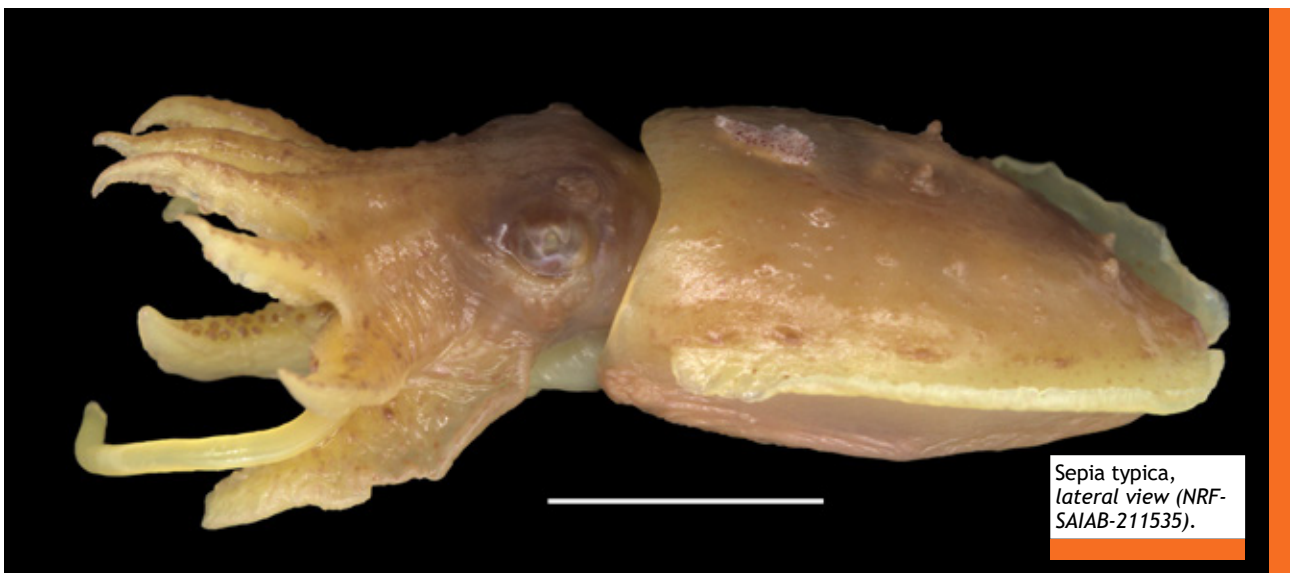
and enable tracking time and geographic changes in species distribution and evolution. These trends can also be used to link to human-driven changes in the environment, including climate change. The Collection Platform at NRF-SAIAB is a national facility for acquiring, managing and doing basic (ID-related) research on certain groups of aquatic animals in southern Africa. Large cephalopod collections were acquired in 2013, and transported from Cape Town to Makhanda/Grahamstown by Dr Marek Lipinski and Roger Bills. This initial collection was supplemented by further collections related to RV *Dr Fridtjof Nansen* research projects.

Some cephalopod species are key ecological players in many ecosystems across the globe. They also support fisheries. The same is true for southern African waters. Both ecological and industrial aspects are researched annually by Fisheries Research of DFFE by doing, inter

alia, demersal and pelagic surveys along South African coasts. During these surveys, catches are identified to species and quantified. Proper identification of all components is of crucial importance. This forms the main aim and direction of the NRF-SAIAB cephalopod project: to collect properly identified voucher specimens, and assist in assessing the ecological importance of identified species. Cephalopods from other distant regions serve as a training basis for identification skills in this systematic group.

Context and Impact

The cephalopod project brought an extensive cephalopod collection to NRF-SAIAB. Cephalopod specimens were collected through the former Sea Fisheries Research Institute (Cape Town) and later by various international projects based on the research of RV *Dr Fridtjof Nansen* in various areas of the world, mainly around southern Africa. The cephalopod collection is being worked in two main directions. First, is the identification of specimens to species level, and an accession process. Second, is the publication of research papers, based upon the identified and accessioned material. Several hundred specimens were already identified and accessioned during a working session in November 2022 (87 samples, 31 species, 130 identifications). The following publication was successfully launched: Leslie, R.W., Richardson, A.J. & Lipinski, M.R. 2022. *Detailed description and morphological assessment of Sepia typica* (Steenstrup, 1875) (Cephalopoda: Sepiidae). *Diversity* 14, 1073. Doi.org/10.3390/d14121073.



Sepia typica,
 lateral view (NRF-
 SAIAB-211535).

Appendix A: NRF-SAIAB RESEARCH OUTPUTS 2022

Thomson Reuters Web of Science Index Publications by NRF-SAIAB Scientists, Honorary Research Associates and Postgraduate Students

- Acosta, A.A., Truter, M., Malherbe, W. & Smit, N.J. 2022. Morphological description and molecular characterisation of *Dactylogyrus matlopong* sp. n. (Monogenea: Dactylogyridae) from the South African endemic *Labeobarbus aeneus* (Cyprinidae: Torinae). *Folia Parasitologica* 69, 21 DOI:10.14411/fp.2022.021
- Amorim, P.F., Katz, A.M., Ottoni, F.P. & de Braganca, P.H.N. 2022. Genetic Structure of the Mangrove Killifish *Kryptolebias hermaphroditus* Costa, 2011 (Cyprinodontiformes: Aplocheiloidei) Supports A Wide Connection among its Populations. *Zoological Studies* 61(4), 1.
- Andrzejaczek, S., Lucas, T.C.D., et al. 2022. Diving into the vertical dimension of elasmobranch movement ecology. *Science Advances* 8(33), DOI: 10.1126/sciadv.abo1754
- Bailey, L.A., Childs, A.R., James, N.C., Winkler, A. & Potts, W.M. 2022. Links between behaviour and metabolic physiology in fishes in the Anthropocene. *Reviews in Fish Biology and Fisheries* 32(2), 555-579.
- Baldanzi, S., Saldías, G.S., Vargas, C.A., & Porri, F. 2022. Long-term environmental variability modulates the epigenetics of maternal traits of kelp crabs in the coast of Chile. *Scientific Reports* 12, art. no. 18806.
- Barkhuizen, L.M., Madzivanzira, T.C. & South, J. 2022. Population ecology of a wild population of red swamp crayfish *Procambarus clarkii* (Girard, 1852) in the Free State Province, South Africa and implications for eradication efforts. *Bioinvasions Records* 11(1), 181-191.
- Bellingan, T.A., Hugo, S., Villet, M.H. & Weyl, O.L.F. 2022. Season and environment modulate aquatic invertebrates' responses to trout and indigenous fishes in three South African mountain streams. *Frontiers in Environmental Science* 10, doi 10.3389/fenvs.2022.1004939
- Bragança, P.H.N., Bellstedt, D.U., de wet van der Merwe, P., Cotterill, F.P.D., Watters, B.R. & Chakona, A. 2022. *Nothobranchius balamaensis* (Cyprinodontiformes: Nothobranchiidae), a new species of annual killifish from northern Mozambique. *Zootaxa* 51745(5), 509-524
- Broom, C.J., Weyl, O.L.F. & South, J. 2022. Habitat associations of imperilled fishes after conservation intervention in the Cape Fold Ecoregion. *South Africa Journal of Fish Biology* 102(2), 317-327.
- Cerrilla, C., Afrika, J., Impson, D., Jordaan, M.S., Kotze, N., Paxton, B.R., Reed, C., Schumann, M., van der Walt, J.A., & Shelton, J.M. 2022. Rapid population decline in one of the last recruiting populations of the endangered Clanwilliam sandfish (*Labeo seeberi*): The roles of climate change and non-native fish. *Aquatic Conservation - Marine and Freshwater Ecosystems* 32(5), 781-796.
- Chaabane, A., Du Preez, L., Johnstone, G.R. & Verneau, O. 2022. Revision of the systematics of the Polystomoidinae (Platyhelminthes, Monogenea, Polystomatidae) with redefinition of *Polystomoides* Ward, 1917 and *Uteropolystomoides* Tinsley, 2017. *Parasite* 29, 56.
- Chakona, A., Jordaan, M.S., Raimondo, D.C., Bills, R., Skelton, P.H. & van der Colff, D. 2022. Diversity, distribution and extinction risk of native freshwater fishes of South Africa. *Journal of Fish Biology* 100(4), 1044-1061.
- Clark, B.M., Turpie, J.K., Cullis, J.D.S., Dawson, J., Dobinson, L., Kunneke, M.M. & Horn, A. 2022. The impacts of long-term flow reductions and an extreme drought on a large, permanently open estuary, and implications for setting the ecological reserve. *Water SA* 48(2), 134-150.
- Conradie, W., Keates, C., Baptista, N.L. & Lobon-Róvira, J. 2022. Taxonomical review of *Prosymna angolensis* Boulenger, 1915 (Elapoidea, Prosymnidae) with the description of two new species. *Water SA* 48(2), 134-150.
- Conradie, W., Keates, C., Verburgt, L., Baptista, N.L., Harvey, J., Julio, T. & Neef, G. 2022. Contributions to the herpetofauna of the Angolan Okavango-Cuando-Zambezi River drainages. Part 2: Lizards (Sauria), chelonians, and crocodiles. *Amphibian and Reptile Conservation* 16(2), 181-214.
- Cortelezzi, P., Paulet, T.G., Olbers, J.M., Harris, J.M. & Bernard, A.T.F. 2022. Conservation benefits of a marine protected area on South African chondrichthyan. *Journal of Environmental Management* 319, DOI: 10.1016/j.jenvman.2022.115691
- Dalu, T., Cuthbert, R.N., Makhuvha, L., Dondofema, F. & Wasserman, R.J. 2022. Assessing variation in below-ground organic matter dynamics in the Ramsar-declared Nylsvley Wetland system, South Africa. *Chemistry and Ecology* 38(7), 617-635.
- Dalu, T., Cuthbert, R.N., Methi, M.J., Chari, L.D. & Wasserman, R.J. 2022. Drivers of aquatic macroinvertebrate communities in a Ramsar declared wetland system. *Science of the Total Environment* 818, art. no. 151683.
- Dalu, T., Cuthbert, R.N., Moyo, S., Wasserman, R.J., Chari, L.D., Weyl, O.L.F. & Jackson, M.C. 2022. Invasive carp alter trophic niches of consumers and basal resources in African reservoirs. *Science of the Total Environment* 813, art. no. 152625.
- Dalu, T., Cuthbert, R.N. & Wasserman, R.J. 2022. Limited plankton community shifts over winter inundation events in Austral temporary wetlands. *Chemistry and Ecology* 38 (6), 586-601.
- Dalu, M.T.B., Mukhuwana, O., Cuthbert, R.N., Marambanyika, T., Gunter, A.W., Murungweni,

- F. & Dalu, T. 2022. Understanding communities' perceptions, demographics and uses of wetlands in Vhembe Biosphere Reserve, South Africa. *Wetlands Ecology and Management* 30(6), 1231-1244.
22. Dalu, T., Mwedzi, T., Wasserman, R.J., Madzivanzira, T.C., Nhwatiwa, T. & Cuthbert, R.N. 2022. Land use effects on water quality, habitat, and macroinvertebrate and diatom communities in African highland streams. *Science of the Total Environment* 846, art. no. 157346.
 23. Daly, R. Jordaan, G.L., Parker, D., Cliff, G., Khabi, N., Kyle, R., Fennessy, S.T. & Mann, B.Q. 2022. Movement patterns and catch trends of the diamond ray *Gymnura natalensis* (Dasyatidae) in South African waters. *African Journal of Marine Science* 44(1), 35-48.
 24. de Necker, L., Brendonck, L., Gerber, R., Lemmens, P., Soto, D.X., Ikenaka, Y., Ishizuka, M., Wepener, V. & Smit, N.J. 2022. Drought altered trophic dynamics of an important natural saline lake: A stable isotope approach. *Science of the Total Environment* 834, art. no. 155338.
 25. Diedericks, G., Broeckhoven, C., Hui, C & von der Heyden, S. 2022. The Role of Directed Dispersal in Driving Genetic and Morphological Structure in Invasive Smallmouth Bass. *Frontiers in Ecology and Evolution* 9, art. no. 790829.
 26. du Preez, L.H., Domingues, M.V. & Verneau, O. 2022. Classification of pleurodire polystomes (Platyhelminthes, Monogenea, Polystomatidae) revisited with the description of two new genera from the Australian and Neotropical Realms. *International Journal for Parasitology: Parasites and Wildlife* 19, DOI:10.1016/j.ijppaw.2022.09.004
 27. Edworthy, C., Potts, W.M., Dupont, S., Duncan, M.I., Bornman, T.G. & James, N.C. 2022. A baseline assessment of coastal pH variability in a temperate South African embayment: implications for biological ocean acidification research. *African Journal of Marine Science* 44(4), 367-381.
 28. Elston, C., Cowley, P.D., von Brandis, R.G. & Lea, J. 2022. Stingray Habitat Use Is Dynamically Influenced by Temperature and Tides. *Frontiers in Marine Science* 8, DOI: 10.3389/fmars.2021.754404.
 29. Elston, C., Cowley, P.D., Murray, T.S. & Parkinson, M.C. 2022. Novel insights into coastal site affinity and habitat connectivity of a benthic stingray with implications for management. *Biodiversity and Conservation* 32(1), 181-202.
 30. Embke, H.S., Nyboer, E.A., et al. 2022. Global dataset of species-specific inland recreational fisheries harvest for consumption. *Scientific Data* 9, art. no. 488 (2022).
 31. Farooq, H., Nanvonamquitxo, C., Nassongole, B.A.F., Conradie, W., Bills, I.R., Soares, A. & Antonelli, A. 2022. Shedding light on a biodiversity dark spot: Survey of amphibians and reptiles of Pemba region in northern Mozambique. *Herpetological Conservation and Biology* 17(2), 423-432.
 32. Fujiwara, K., Psomadakis, P.N., Swe, T.Y.Y. & Motomura, H. 2022. First records of the two gobies, *Cryptocentrus shigensis* and *Priolepis profunda* (Actinopterygii: Gobiiformes: Gobiidae), from the Andaman Sea. *Acta Ichthyologica et Piscatoria* 52(1), 21-27.
 33. Fusi, M., Booth, J.M., Marasco, R., Merlino, G., Garcias-Bonet, N., Barozzi, A., Garuglieri, E., Mbobo, T., Diele, K., Duarte, C.M & Daffonchio, D. 2022. Bioturbation Intensity Modifies the Sediment Microbiome and Biochemistry and Supports Plant Growth in an Arid Mangrove System. *Microbiology Spectrum* 10(3), art. no. e0111722.
 34. Garuglieri, E., Booth, J.M., Fusi, M., Yang, X., Marasco, R., Mbobo, T., Clementi, E., Sacchi, L. & Daffonchio, D. 2022. Morphological characteristics and abundance of prokaryotes associated with gills in mangrove brachyuran crabs living along a tidal gradient. *Plos One* 17(4), art. no. e0266977.
 35. Gennari, E., Irion, D.T. & Cowley, P.D. 2022. Active acoustic telemetry reveals ontogenetic habitat-related variations in the coastal movement ecology of the white shark. *Animal Biotelemetry* 10(1), DOI:10.1186/s40317-022-00295-x
 36. Glass, J.R., Belle, K., Berke, G., Bodin, N., Burt, A., Duncan, M., Morgan, S.K., Pillay, P., & Talma, S. 2022. Evaluating the Feasibility of Sustainable Seafood Labelling Programmes in Small Island Developing States: A Pilot Study of Artisanal Fisheries in Seychelles. *Frontiers in Marine Science* 9, art. no. 931407.
 37. Gon, O., Assel, E., Anderson, E. & Maclaine, J. 2022. A taxonomic re-evaluation of five stomiiform fish species described by August Brauer (1902) with lectotype designations. *Zootaxa* 5196(1), 46-60.
 38. Greben, O., Korniyushin, V., de Preez, L., Melnychuk, V., Yevstafieva, V & Syrota, Y. 2022. Cestodes of the Genus *Fimbriaria* Froelich, 1802 (Cestoda, Cyclophyllidea, Fimbriariinae) from Ukraine, with a Key to Species Level. *Acta Parasitologica* 68(1), 145-158.
 39. Hanzen, C.C., Lucas, M.C., Weyl, O.L.F., Marr, S.M., O'Brien, G.C. & Downs, C.T. 2022. Slippery customers for conservation: Distribution and decline of anguillid eels in South Africa. *Aquatic Conservation - Marine and Freshwater Ecosystems* 32(8), 1277-1290.
 40. Harden-Davies, H., Amon, D.J., Chung, T-R., Gobin, J., Hanich, Q., Hassanali, K., Jaspars, M., Soapi, K., Talma, S. & Vierros, M. 2022. How can a new UN ocean treaty change the course of capacity building? *Aquatic Conservation - Marine and Freshwater Ecosystems* 32(5), 907-912.
 41. Harnoster, F., du Preez, L.H. & Svitin, R. 2022. Three new species of *Cosmocerca* Diesing, 1861 (Nematoda: Cosmocercidae) parasitising frogs *Cacosternum boettgeri* Boulenger, 1882, *Kassina senegalensis* Dumeril and Bibron, 1841 and *Phrynomantis bifasciatus* Smith, 1847 from South Africa. *Parasitology Research* 121(2), 563-571.
 42. Harrison, T.D. & Whitfield, A.K. 2022. Global biogeography of estuary-associated fishes. *Journal of the Maine Biological Association of the United Kingdom* 102(1-2), 113-131.
 43. Heyns-Veale, E.R., Bernard, A.T.F., Midgley, J.M. & Herbert, D.G. 2022. The distribution of offshore benthic molluscs provides new insight into South Africa's marine biogeography. *Ocean & Coastal*

- Management* 217(6), art. no. 106001.
44. Holleman, W., Gouws, G., Glass, J. & Mann, B.Q. 2022. Resurrection of *Lethrinus scoparius* Gilchrist & Thompson, 1908 (Perciformes: Lethrinidae), from South African waters. *Zootaxa* 5174(5), 551-567.
 45. Holmes, M., Campbell, E.E., de Wit, M. & Taylor, J.C. 2022. The impact of drought in the Karoo-revisiting diatoms as water quality indicators in the upper reaches of the Great Fish River, Eastern Cape, South Africa. *South African Journal of Botany* 149, 502-510.
 46. Holness, S.D. Harris, L.R., Chalmers, R., de Vos, D., Goodall, V., Truter, H.J., Oosthuizen, A., Bernard, Cowley, P., da Silva, C., A., Dicken, M., Edwards, L., Marchand, G., Martin, P., Murray, T.S., Parkinson, M., Patrick, P., Pichegru, L., Pistorius, P., Sauer, W.H.H., Smale, M., Thiebault, A. & Lombard, A.T. 2022. Using systematic conservation planning to align priority areas for biodiversity and nature-based activities in marine spatial planning: A real-world application in contested marine space. *Biological Conservation* 271 (3), 109574
 47. Jabado, R.W., Ebert, D.A. & Al Dhaheri, S.S. 2022. Resolution of the *Aetomylaeus nichofii* species complex, with the description of a new eagle ray species from the northwest Indian Ocean and a key to the genus *Aetomylaeus* (Myliobatiformes: Myliobatidae). *Marine Biodiversity* 52, art. no. 15.
 48. Jacobs, F.J., Naesje, T.F., Ulvan, E.M., Hay, C., Khaebbeb, F.H. & Weyl, O.L.F. 2022. Evidence for overfishing of tigerfish *Hydrocynus vittatus* (Castelnau 1861) in the Kavango River, Namibia. *African Journal of Aquatic Science* 47(2), 207-215.
 49. James, N.C., Childs, A-R., Kemp, J., Wilsnagh, S. & Edworthy, C. 2022. Turbidity influences the recruitment of *Argyrosomus japonicus* to estuarine nurseries. *Frontiers in Marine Science* 9, doi.org/10.3389/fmars.2022.953607
 50. James, N.C. & Harrison, T.D. 2022. A preliminary fish survey of the estuaries on the east coast of South Africa, Mpande to Mtentwana: a comparative study. *Water SA* 48(4), 394-412.
 51. Kakehashi, R., Hemmi, K., Landman, W., Furuno, N., du Preez, L., Minter, L. & Kurabayashi, A. 2022. Better than mere attraction - adhesive properties of skin secretion in the Common Rain Frog, *Breviceps adpersus*. *Salamandra* 58(1), 43-51.
 52. Kalinski, J-C.J., Polyzois, A., Waterworth, S.C., Noundou, X.S., & Dorrington, R.A. 2022. Current Perspectives on Pyrroloiminoquinones: Distribution, Biosynthesis and Drug Discovery Potential. *Molecules* 27(24), art. no. 8724
 53. Keates, C., Conradie, W., Dalu, T., Dondofema, F., Riddel, E.S. & Wasserman, R.J. 2022. Phylogenetic placement of the enigmatic floodplain water snake, *Lycodonomorphus obscuriventris* FitzSimons, 1964. *Koedoe* 64(1), art. no. 1698.
 54. Khosa, D., Hargrove, J.S., Peatman, E. & Weyl, O.L.F. 2022. The extent of hybridisation between largemouth bass and Florida bass across two river systems in South Africa. *African Journal of Aquatic Science* 47(4), 507-519.
 55. Knuckey, J.D.S., & Ebert, D.A. 2022. A taxonomic revision of Northeast Pacific softnose skates (Rajiformes: Arhynchobatidae: Bathyraja Ishiyama). *Zootaxa* 5142(1), 1-89. doi.org/10.11646/zootaxa.5142.1.1
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 57. Kock, A., Smit, N.J., Taylor, J.C., Wolmarans, N.J. & Wepener, V. 2022. A lentic microcosm approach to determine the toxicity of DDT and deltamethrin on diatom communities. *Environmental Pollution* 312, DOI: 10.1016/j.envpol.2022.120037
 58. Kruger, N., Secondi, J., du Preez, L., Herrel, A. & Measey, J. 2022. Phenotypic variation in *Xenopus laevis* tadpoles from contrasting climatic regimes is the result of adaptation and plasticity. *Oecologia* 200(1-2), 37-50.
 59. Kuzmin, Y., du Preez, L., Nel, T. & Svitin, R. 2022. Three new species of *Rhabdias* Stiles et Hassall, 1905 (Nematoda: Rhabdiasidae) parasitic in *Ptychadena* spp. (Amphibia: Anura: Ptychadenidae) and an identification key to *Rhabdias* spp. from Afrotropical anurans. *Parasitology International* 91, art. no. 102649.
 60. Leslie, R.W., Richardson, A.J. and Lipinski, M.R. 2022. Detailed Description and Morphological Assessment of *Sepia typica* (Steenstrup, 1875) (Cephalopoda: Sepiidae). *Diversity-Basel* 14(12), art. no. 1073.
 61. Leuci, R., Wiles, E., Thackeray, Z. & Vella, G. 2022. Trends in sandy beach variability EThekweni Municipality, South Africa. *Journal of Sea Research* 179, art.no. 102149.
 62. Lobon-Rovira, J., Conradie, W., Vaz Pinto, P., Keates, C., Edwards, S., du Plessis, A. & Branch, W.R. 2022. Systematic revision of *Afrogecko ansorgii* (Boulenger, 1907) (Sauria: Gekkonidae) from western Angola. *Zootaxa* 5124(4), 401-430.
 63. Lubitz, N., Bradley, M., Sheaves, M., Hammerschal, N., Daly, R. & Barnett, A. 2022. The role of context in elucidating drivers of animal movement. *Ecology & Evolution* 12(7), art.no. e9128.
 64. Madsen, H. & Stauffer, J.R. Jr. 2022. Schistosomiasis Control Under Changing Ecological Settings in Lake Malawi. *Ecohealth* 19(3), 320-323.
 65. Madsen, H., Nguyen, H.M., Ianza, G.R. & Stauffer, J.R. Jr. 2022. A One Health Approach Relative to Trematode-Caused Diseases of People and Animals Associated with Aquaculture. *Reviews in Fisheries Science & Aquaculture* 30(4), 542-566.
 66. Madzivanzira, T.C. 2022. Towards the conservation of wetlands in the tropics. *South African Journal of Science* 118(7-8), DOI: https://doi.org/10.17159/sajs.2022/12923
 67. Madzivanzira, T.C., Weyl, O.L.F. & South, J. 2022. Ecological and potential socioeconomic impacts of two globally-invasive crayfish. *NeoBiota* 72,

- 25-43.
68. Majdi, N., de Necker, L., Fourie, H., Loggenberg, A., Netherlands, E.C., Bunte-Tschikin, J., Traunsberger, W. & du Preez, G.C. 2022. Diversity and distribution of benthic invertebrates dwelling rivers of the Kruger National Park, South Africa. *Koedoe* 64(1), art. no. 1702.
 69. Makherana, F., Cuthbert, R.N., Dondofema, F., Wasserman, R.J., Chauke, G.M., Munyai, L.F. & Dalu, T. 2022. Distribution, drivers and population structure of the invasive alien snail *Tarebia granifera* in the Luvuvhu system, South Africa. *River Research and Applications Special Issue paper* 38(8), 1362-1373.
 70. Mann, B., Daly, R., Jordaan, G.L., Dalton, W.N. & Fennessy, S.T. 2022. Movement behaviour of catface rockcod *Mycteroperca (Epinephelus) andersoni* (Epinephelidae) off the eastern seaboard of southern Africa. *African Journal of Marine Science* 44(2), 125-137.
 71. McInturf, A.G., Muhling, B., Bizzarro, J., Fanguie, N.A., Ebert, D.A., Caillaud, D. & Dewar, H. 2022. Spatial Distribution, Temporal Changes, and Knowledge Gaps in Basking Shark (*Cetorhinus maximus*) Sightings in the California Current Ecosystem. *Frontiers in Marine Science* doi.org/10.3389/fmars.2022.818670
 72. Molina-Salgado, P., Gonzalez-Pestana, A., Alfaro-Shigueto, J. & Ebert, D.A. 2022. Description of egg capsules of Rasptail Skate *Rostroraja velezi* (Chondrichthyes: Rajiformes: Rajidae) from northern Peru. *Environmental Biology of Fishes* 105(5), 663-668.
 73. Mpakairi, K.S., Dube, T., Dondofema, F & Dalu, T. 2022. Spatio-temporal variation of vegetation heterogeneity in groundwater dependent ecosystems within arid environments. *Ecological Informatics* 69, doi.org/10.1016/j.ecoinf.2022.101667
 74. Mpakairi, K.S., Dube, T., Dondofema, F. & Dalu, T. 2022. Spatial Characterisation of Vegetation Diversity in Groundwater-Dependent Ecosystems Using In-Situ and Sentinel-2 MSI Satellite Data. *Remote Sensing* 14(13), doi:10.3390/rs14132995
 75. Munyai, L.F., Dalu, T., Wasserman, R.W., Mugwedi, L., Dondofema, F., O'Brien, G. & Cuthbert, R.N. 2022. Functional Responses and Additive Multiple Predator Effects of Two Common Wetland Fish. *Water* 14(5), doi:10.3390/w14050699
 76. Murray, T.S., Elston, C., Parkinson, M.C., Filmlalter, J.D. & Cowley, P.D. 2022. A Decade of South Africa's Acoustic Tracking Array Platform: An Example of a Successful Ocean Stewardship Programme. *Frontiers in Marine Science* 9, doi.org/10.3389/fmars.2022.886554
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Books, book chapters and book reviews

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 8. Whitfield, A.K., Able, K.W., Blaber, S.J.M., Elliott, M., Franco, A., Harrison, T.D., Potter, I.C. & Tweedley, J.R. 2022. Chapter 2: Fish assemblages and functional groups. In: *Fish and Fisheries in Estuaries - A Global Perspective* (Whitfield, A.K., Able, K.W., Blaber, S.J.M. & Elliott, M., ed.), pp. 16-59. Wiley Blackwell, Oxford, UK.
 9. Whitfield, A.K., Able, K.W., Blaber, S.J.M., Elliott, M., Franco, A., Harrison, T.D. & Houde, E.D. 2022. Chapter 5: Feeding ecology and trophic dynamics. In: *Fish and Fisheries in Estuaries - A Global Perspective* (Whitfield, A.K., Able, K.W., Blaber, S.J.M. & Elliott, M., ed.), pp. 255-331. Wiley Blackwell, Oxford, UK.

Reports and theses

1. Jacobs, A. 2022. Shallow-water seascape connectivity: prey resources and food web dynamics of juvenile sparid fishes in a shallow subtidal reef in Algoa Bay, South Africa. MSc. Nelson Mandela University
2. Khomokhumo, E. 2022. Molecular characterization of microbial communities in the Sundays and Swartkops Estuaries impacted by anthropogenic activities. MSc. Rhodes University.
3. Mataboge, B.B. 2022. The effects of temperature and exploitation on the behaviour of red roman *Chrysoblephus laticeps* (Sparidae) at baited video stations. MSc. Rhodes University.
4. Mkhize, T. 2022. Habitat use by juvenile coastal fish in subtidal vegetated habitats of Algoa Bay's shallow-water seascape. MSc. Nelson Mandela University.
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6. Ndaleni, P.M. 2022. Understanding resource partitioning in three species of Gobiidae living in the warm-temperate Sundays Estuary. PhD. Rhodes University.
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Popular articles and other publications

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2. Dlamini, L. 2022. Fish and Fisheries in Estuaries: A Global Perspective. Book Feature. March 2022.
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5. Dlamini, L. 2022. Study underway to determine spread of invasive alien Nile tilapia: A major threat to South Africa's biodiversity. *NRF Q1 Business Highlights Publication*. August 2022.
6. Dlamini, L. 2022. NRF-SAIAB PhD student elected as Student Representative at SAMSS Conference. *NRF Q1 Business Highlights Publication*. August 2022.
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8. Dlamini L. 2022. Two advert placements: (1) Coastal Fishes of the Western Indian Ocean and (2) generic advert promoting NRF-SAIAB's work and its research platforms. *Quest* 18(3), 44-45 <https://questonline.org.za/3d-flip-book/quest-vol-18-no-3/>. October 2022.
9. Dlamini, L. 2022. NRF-SAIAB and MILE Host UniZulu Postgraduate Students for Summer School Programme. *NRF Q2 Business Highlights Publication*. November 2022.
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12. Dlamini, L. & Bragança P. 2022. Diversity of the lampeye fishes: Identifying the diversity of the southern Africa lampeye fishes (*Lacustricola*). July 2022.
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 14. Dlamini, L. & Elston, C. 2022. Dr Chantel Elston shows the wonders beneath the waves at Plett's Keurbooms estuary. *NRF-SAIAB Latest News Website*. August 2022.
 15. Dlamini, L & Madzivanzira, T. 2022. Dr Takudzwa Madzivanzira Receives NRF Award. *NRF Business Highlights Publication*. February 2022.
 16. Dlamini, L & Porri F. 2022. Science with and for Society: The NRF-SAIAB IMsEE project case study - published by the international Network for Advancing and Evaluating the Societal Impact of Science (AESIS Network), newsletter themed, 'Community Engagement through Science': <http://us7.forward-to-friend.com/forward/w?u=7807491176d53828422c909a9&id=f98a912c7a>. September 2022.
 17. Elston, C. 2022. Hooray for rays! Stingray conservation in a small South African town. *Xtinct magazine article*. <https://digital.xtinctmagazine.com/articles/hooray-for-rays>
 18. Elston, C. and Lintott, L. 2022. It's getting hot in here! How does temperature affect shark egg development? *ELMO Africa blog post*. <https://www.elmoafrica.org/post/it-s-getting-hot-in-here-how-does-temperature-affect-shark-egg-development>
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 20. Haworth P. & Dlamini, L. 2022. Fundamentals of Tropical Freshwater Wetlands: From Ecology to Conservation Management. Book Feature. January 2022.
 21. Haworth, P. & Murray, T. 2022. NRF-SAIAB 2022 Calendar. March 2022.
 22. James, N. & Potts, W. 2022. Climate change impacts on South Africa's coastal and estuarine fishes. *NRF Science Matters* 4(3), 4-5. February 2022.
 23. Klaas, A. 2022. (IsiXhosa translated version) Installation of life-saving devices at Grey Dam. January 2022.
 24. Magoro, M & Dlamini, L. 2022. Invasion of the Nile tilapia: 140 dams and rivers sampled in two months to map the spread in Limpopo and Mpumalanga. *Quest* 18(3),12-14 <https://questonline.org.za/3d-flip-book/quest-vol-18-no-3/>. October 2022
 25. Murray, T. 2022. Estuarine fisheries: where salt water, fresh water and people meet. *Quest* 18(3),15-16 <https://questonline.org.za/3d-flip-book/quest-vol-18-no-3/>. October 2022
 26. Parkinson, M. 2022. Installation of life-saving devices at Grey Dam. (NRF-SAIAB initiative in collaboration with the National Sea Rescue Institute (NSRI)). January 2022.
 27. Skelton, P. 2022. Angola adventures with bubblenesters. Wild Bird Trust, National geographic Okavango Wilderness Project. Labyrinth. *Newsletter of the Anabantoid Association of Great Britain*, February 2022, 4-8.
 28. Truter, M. 2022. Award Winnings for NRF-SAIAB research fellows at North-West University. *NRF-SAIAB Latest News Website*. October 2022.
 29. Watson, R. & Murray, T. 2022. The little leopard catshark that could. *Save Our Seas Foundation blog post*: <https://saveourseas.com/update/the-little-leopard-catshark-that-could/>.
 30. Weyl*, O.L.F. & South, J. 2022. Aquatic pollution and the African clawed frog. *NRF Science Matters* 4(3), 6-7. February 2022.
 31. Weyl*, O.L.F. & South, J. 2022. Can an alien invasion doom our inland fisheries? *NRF Science Matters* 4(3), 20--21. February 2022.

Engaged research video productions:

- DSI/NRF-SAIAB/UFH Bio-economy & Bio-discovery Joint Marine Laboratory (JML) launch video - March 2022
- DSI/NRF-SAIAB/UFH Bio-economy & Bio-discovery Joint Marine Laboratory (JML) launch video - March 2022
- World Oceans Day - Life below the ocean video. June 2022.
- Shark Awareness Day - awareness video about stingray sharks. July 2022.

National Science Week video series – August 2022:

- The Water Cycle - video explaining how water moves through the water cycle, connecting the ocean, streams, rivers and land.
- Species preservation at the NRF-SAIAB Collections Facility - video shows the application of science by explaining some of the education specimens kept at the NRF-SAIAB Collections Facility.
- Frogs of southern Africa - video explaining NRF-SAIAB's extended collection of amphibians such as frogs.
- Biobank Platform at NRF-SAIAB - video showing how and where tissue samples are stored and preserved.
- Metabarcoding - video showcasing a Metabarcoding NGS (Next Generation Sequencing) training workshop.

Conference and symposium presentations

1. Bailey, L., Childs, A-R., James, N.C. & Potts, W. 2022. Using behaviour and aerobic scope phenotypes to predict the survival of linefish under climate variability. 17th South African Marine Science Symposium (SAMSS). June 2022.
2. Bernard, A., Samoily, M., Jubu, R., Musembi, P., Eddine, Y., Woodall, L., Tohir, I.; Harris, J. & Stefanoudis, P. 2022. Depth zonation and environmental drivers of shallow and mesophotic reef assemblages in the Comoros.

- Western Indian Ocean Marine Science Association Symposium. October 2022.
3. Bragança, P.H.N., Jouke, Van der Zee., Lobel, P. S. & Schliwen, U. 2022. Osteology and redescription of the miniature lampeye species of *Congopanchax* Poll, 1971 (Cyprinodontiformes: Procatopodidae) with an updated list and overview of the African freshwater miniature fishes. Southern African Society of Aquatic Scientists (SASAqS) 2022 congress, Free State. June 2022.
 4. Coetzer, W. & Becker, F. 2022. Revolutionising collection management at the National Museum of Namibia. Biodiversity Information Standards TDWG Annual Conference, Sofia, Bulgaria. October 2022.
 5. de Necker, L., Brendonck, L., Gerber, R., Lemmens, P., Soto, D.X., Ikenaka, Y., Ishizuka, M., Wepener, V. & Smit, N.J. 2022. Drought altered trophic dynamics of an important natural saline lake: A stable isotope approach. South African Society of Aquatic Scientists (SASAqS), Brandfort, Free State. June 2022.
 6. de Necker, L., Le Roux, M.H., Mothapo, N., Lindeque, F., Smit, N.J. & Wepener, V. 2022. Schistosomiasis in South Africa: vector distribution and human perceptions and practices. WaterNet Conference. Sun City, Rustenburg, North West, South Africa. October 2022.
 7. Dlamini, L.B. 2022. Bridging the gap in communication between researchers and the general public. South African Marine Science Symposium (SAMSS). June 2022.
 8. Duna, O. 2022. The effects of easterly and westerly winds on the settlement and recruitment of intertidal invertebrates. 17th Southern Africa Marine Science Symposium (SAMSS). June 2022.
 9. Edworthy, C. James, N.C. 2022. The potential for dense macroalgal vegetation to serve as ocean acidification refugia. Western Indian Ocean Marine Science Symposium, October 2022.
 10. Edworthy, C., James, N.C., Potts, W.M. and Dupont, S. 2022. Variability in pH and associated parameters in a dynamic coastal embayment. Ocean Science Meeting, February/March 2022.
 11. Edworthy C., James N.C., Potts W.M. & Dupont, S. 2022. Combining monitoring and eco-physiology for ocean acidification research. South African Marine Science Symposium (SAMSS). June 2022.
 12. Edworthy C., James N.C., Potts W.M., Dupont, S. 2022. Combining monitoring and eco-physiology to assess the response of a coastal fish to ocean acidification. 5th International Symposium on Oceans in a High-CO₂ World Conference, Lima, Peru. September 2022.
 13. Elston, C., Cowley, P.D., Murray, T.S., Parkinson, M.C. 2022. First insights into the large-scale movements of a benthic stingray. Sharks International, Valencia. October 2022.
 14. Erasmus, J. H., Truter, M., Smit, N. J., Zimmerman, S., Sures, B., Wepener, V. 2022. One health approach to the assessment of element contamination of the Orange-Vaal River systems, South Africa. 23rd WaterNet/WARDSAGWP-SA Symposium, Sun City Resort. October 2022.
 15. Gayiza, M., James, N.C., Bernard, A. & Steyn, P-P. 2022. Nursery provision of macroalgae reefs in a coastal seascape in Algoa Bay. 17th South African Marine Science Symposium (SAMSS). June 2022.
 16. Gayiza, M., James, N.C., Bernard, A. and Steyn, P-P. 2022. The importance of structural complexity for nursery provision within a mosaic of habitats in a temperate rocky cove. 12th WIOMSA Scientific Symposium. October 2022.
 17. Gibb, R.A., Bornman, T.G.B. & Dorrington, R.A. Molecular techniques provide insight into the importance of phytoplankton communities as ecosystem indicators. Western Indian Ocean Marine Science Symposium. October 2022.
 18. Haupt, T., Stefanoudis, P., von der Meden, C., Payne, R., Adams, L., Bernard, A., van der Heever, G., Kock, A & Nadjim, A. 2022. The Western Indian Ocean Regional Benthic Imagery Workshop: A capacity development initiative. Western Indian Ocean Marine Science Association Symposium. October 2022.
 19. James, N.C. 2022. Climate change effects on estuaries and associated fish. 22nd National MCEN Conference. March 2022.
 20. James, N.C., Childs, A-R., Rishworth, G., Rajkaran, A., Human, L., Steyn, P-P, Adams, J., Murray, T., Edworthy, C., Mkhize, T., Nodo, P., Jacobs, A., Gayiza, M., Pollard, M. & Brown, K. 2022. The seascape of coastal nursery areas in temperate Algoa Bay, South Africa. Ocean Science Meeting. February/March 2022.
 21. James, N.C., Childs, A-R., Rishworth, G., Rajkaran, A., Human, L., Steyn, P-P, Adams, J., Murray, T., Edworthy, C., Mkhize, T., Nodo, P., Jacobs, A., Gayiza, M., Pollard, M. & Brown, K. 2022. The seascape of coastal nursery areas in temperate Algoa Bay, South Africa. 17th South African Marine Science Symposium (SAMSS). June 2022.
 22. James, N.C., Childs, A-R., Rishworth, G., Rajkaran, A., Human, L., Steyn, P-P, Adams, J., Murray, T., Mkhize, T., Nodo, P., Jacobs, A., Gayiza, M., Pollard, M. & Brown, K. 2022. The seascape of coastal nursery areas in temperate Algoa Bay, South Africa. Estuarine Coastal and Shelf Science Association (ECSA) Conference, San Sebastian, Spain. September 2022.
 23. James, N.C., Jacobs, A., Gayiza, M., Pollard, M., Mkhize, T, Murray, T., Childs, A., Human, L., Steyn, P-P., Rishworth, G. & Bernard, A. 2022. The role of macroalgae reefs as nursery areas within the Algoa Bay coastal seascape. 12th WIOMSA Scientific Symposium. October 2022.
 24. Khosa, D., Hargrove, J.S., Peatman, E. & Weyl, O.L.F. 2022. The extent of hybridisation between Largemouth Bass and Florida Bass across two river systems in South Africa. National Symposium on Biological Invasions, University of Fort Hare. July 2022.
 25. Khosa, D., South, J., Matam, N.Y., Mofu, L., Wasserman, R.J., Weyl, O.L.F. 2022. The current distribution of native and non-native fish in the Kowie River catchment, Makhanda, Eastern Cape. Southern African Society of Aquatic Scientists Congress. June 2022.
 26. Lamberth, S.J., Baur, N., Bornman, T., Brett, G., James, N.C., Krug, M., Russo, C. & Steyn, P-P. 2022. A sequential account of major ocean

- weather anomaly, direct and indirect impacts on marine life. 17th South African Marine Science Symposium (SAMSS). June 2022.
27. Le Roux, M.H., de Necker, L., Lawton, S. & Smit, N.J. 2022. Decline in the native freshwater snail diversity of the Limpopo River system, South Africa: a cause for concern. South African Society of Aquatic Scientists (SASAqS), Brandfort, Free State. June 2022.
 28. Letlaila, F., Ayob, N., Nkosi, N. & de Necker, L. 2022. The influence of water quality on the Schistosoma ecosystems within Mbombela and Nkomazi local municipalities. WaterNet Conference. Sun City, Rustenburg, North West, South Africa. October 2022.
 29. Meiklejohn, A., Childs, A-R., Smith, K., Meiklejohn, I., Nodo, P. & James, N.C. Spatial and temporal analysis of fish assemblages within the Knysna Estuary System. 17th South African Marine Science Symposium (SAMSS). June 2022.
 30. Mkhize, T., James, N.C., Adams, J. & Parker-Nance, S. 2022. Habitat use by juvenile coastal fish in vegetated habitats of Algoa Bay's shallow-water seascape. 17th South African Marine Science Symposium (SAMSS). June 2022.
 31. Mkhize, T., James, N.C., Parker-Nance, S. and Adams, J. 2022. Structural complexity of *Zostera capensis* and *Plocamium corallorhiza* in the Algoa Bay shallow-water seascape. 12th WIOMSA Scientific Symposium. October 2022.
 32. Mofu L., Dalu T., Wasserman R.J., Woodford D.J. & Weyl, O. L. F. 2022. Patterns of size composition, catch per unit effort and biomass of four colonizers of artificial impoundments. Southern African Society of Aquatic Scientists Congress. June 2022.
 33. Mothapo, N., Lindeque, F., Mothapo, C. & de Necker, L. 2022. Community knowledge, attitudes, perceptions and practices on schistosomiasis in Ha-Nesengani, Limpopo Province. Society of South African Geographers Biennial Conference, Pretoria. September 2022.
 34. Mpanza, N.P., Pegg, J., Magoro, M., Cuthbert, R.N. & Wasserman, R.J. 2022. Resource utilization and morphological trait differences between *Oreochromis mossambicus* and *Oreochromis niloticus* in the Eastern Cape province, South Africa. 22nd International Conference on Aquatic Invasive Species (ICAIS). Ostend, Belgium. April 2022.
 35. Mukhari, D.L., Pegg, J., Elston, C., Murray, T., Bzonek, P., Mandrak, N., Cowley, P.D. & Weyl, O.L.F. 2022. Alien species management: Can acoustic telemetry data be used to optimise catch rates of invasive common carp in South Africa? 22nd International Conference on Aquatic Invasive Species (ICAIS). Ostend, Belgium, April 2022.
 36. Muller, C., Lett, C., Porri, F., Patrick, P., Bailey, D., Denis, H., Barrier, N. & Kaplan, D.M. 2022. Connecting Larval Dispersal Models with Observations of Exploited Fish Along Southern South Africa. 17th Southern Africa Marine Science Symposium (SAMSS). June 2022.
 37. Murray, T., Elston, C., Parkinson, M. & Cowley, P. 2022. Do Marine Protected Areas really protect mobile aquatic animals? Conservation Symposium. October/November 2022.
 38. Murray, T., Elston, C., Parkinson, M. & Cowley, P. 2022. Should I stay or should I go? Fish movement in relation to protected areas. Ocean Tracking Network Symposium. November 2022.
 39. Ndaleni, P., James, N.C., South, J. 2022. Understanding resource partitioning in three species of Gobiidae living in the warm-temperate Sundays Estuary. 17th South African Marine Science Symposium (SAMSS). June 2022.
 40. Nodo, P., James, N.C., Patrick, P. & Childs, A-R. 2022. Nursery function of shallow nearshore and estuarine benthic habitats for demersal fishes in Algoa Bay. 17th South African Marine Science Symposium (SAMSS). June 2022.
 41. Nodo, P., James, N.C., Childs, A-R. & Patrick, P. 2022. The nursery function of shallow marine nearshore and estuarine benthic habitats of Algoa bay for demersal fishes. 12th WIOMSA Scientific Symposium. October 2022.
 42. Nodo, P., James, N.C., Patrick, P. & Childs, A.R. 2022. Nursery function of shallow nearshore and estuarine benthic habitats for demersal fishes in Algoa Bay. Estuarine Coastal and Shelf Science Association (ECSA) Conference, San Sebastian, Spain. September 2022.
 43. Nyawo, M., Bernard, A. & Matcher G. 2022. Protocol development for assessing marine fish assemblages using environmental DNA. Southern African Marine Science Symposium (SAMSS). June 2022.
 44. Oliver J., Sink K.J., Teske P., Mariani S. & Matcher G. 2022. Using cutting-edge molecular tools to detect and monitor elusive marine fishes. Southern African Marine Science Symposium (SAMSS). June 2022.
 45. Palmer, R. 2022. Overview of ACEP work in South Africa. Special Session: Deep Sea. 12th WIOMSA Scientific Symposium. October 2022.
 46. Palmer, R. 2022. Shared equipment facilities Special Session: Deep Sea. 12th WIOMSA Scientific Symposium. October 2022.
 47. Pegg, J., Mpanza, N., Muckhari, D., Kaiser, A. & Weyl, O.L.F. 2022. Common carp - a highly adaptable invasive fish in South Africa's largest river. 22nd International Conference on Aquatic Invasive Species (ICAIS). Ostend, Belgium. April 2022.
 48. Porri, F., 2022. Nurturing a passion for the sea: a curiosity to a solution driven journey. Makhanda, Libertarian Seminars 2022. October 2022.
 49. Porri, F., Patrick, P., Human, L., McConnachie, B., Puccinelli, E., Betani, N., Howse, M., Mvubu, C., Cotiyane-Pondo, van der Walt, K.-A. & Wynberg, R. 2022. Doing coastal science in a transdisciplinary world. Nelson Mandela University, Gqeberha. November 2022.
 50. Porri, F. & McConnachie, B. 2022. Transdisciplinarity through Indigenous knowledge: an ecological co-integration of marine science and music. 16th South African Society for Research in Music (SASRIM) Conference, Makhanda. August 2022.
 51. Porri, F., Patrick, P., Human, L., McConnachie, B., Puccinelli, E., Betani, N., Howse, M., Mvubu, C., Cotiyane-Pondo, van der Walt, K.-A. & Wynberg, R. 2022. Indigenous Marine Innovations for sustainable Environments and Economies: an

- overview of the IMIsEE project. 17th Southern Africa Marine Science Symposium (SAMSS). June 2022.
52. Porri, F., Patrick, P., Human, L., McConnachie, B., Puccinelli, E., Betani, N., Howse, M., Mvubu, C., Cotiyane-Pondo, van der Walt, K.-A. & Wynberg, R. 2022 Nature-based solutions for resilient and biodiverse urban coasts: synergies between African traditional creative expressions and scientific practices. 59th Estuarine and Coastal Sciences Association (ECSA), San Sebastian, Spain. September 2022.
 53. Potts, W.M., Childs, A-R., Muller, C., Bailey, L., Duncan, M., Winkler, A., Van der Walt, K-A., Skeeles, M., Erasmus, B., Edworthy, C. & James, N.C. 2022. Using physiological research findings for future-proofing our coastal fishery species. 17th South African Marine Science Symposium (SAMSS). June 2022.
 54. Puccinelli, E., Porri, F., Altieri, K., Flynn, R., Little, H., Louw, T., Patrick, P., Sparks, C., Tsanwani, M., de Waardt, S., Walker, D. & Fawcett, S. 2022. Coastal Ecosystem Services In False Bay: The Role of Benthic Filter Feeders In Mitigating Pollution 17th Southern Africa Marine Science Symposium (SAMSS). June 2022.
 55. Reddy, S., Patrick, P. & Porri, F. 2022. Larval Assemblages In Intertidal Habitats: The Use of Artificial and Natural Microhabitats. 17th Southern Africa Marine Science Symposium (SAMSS). June 2022.
 56. Reddy, S., Patrick, P. & Porri, F. 2022. The use of artificial and natural microhabitats by fish and invertebrate larvae in intertidal systems. 12th WIOMSA Scientific Symposium. October 2022.
 57. Redelinghuys, S., Porri, F. & Matcher, M. 2022. Gut Bacterial Microbiome of the Sea Urchin *Parechinus angulosus* Using Metabarcoding. 17th Southern Africa Marine Science Symposium (SAMSS). June 2022.
 58. Siteo, J., Sidat, N., Bennett, R., van Beuningen, D., Bernard, A., Juby, R. & Davids, A. 2022. Investigating shark and ray abundance and diversity in Mozambique through baited remote underwater video surveys. Western Indian Ocean Marine Science Association Symposium. October 2022.
 59. Smit, K., Pillay, T., Wiles, E., Cawthra, H. & Bernard, A. 2022. A Multi-Disciplinary Approach to Assessing Reef-Scale Drivers of Biotic Communities on Blood Reef (Durban, South Africa). South African Marine Science Symposium (SAMSS). June 2022.
 60. Smit, K.P., Bernard, A.T.F., Sink, K.J. & Lombard, A.T. Measuring Marine Ecosystem Condition to Support Marine Spatial Planning. South African Marine Science Symposium (SAMSS). June 2022.
 61. Smit, K.P., Bernard, A.T.F., Sink, K.J., Shannon, L & Lombard, A.T. 2022. Groundtruthing National Pressure-Based Assessments Using Fish and Benthic Community Data from Rocky Reef Ecosystems. South African Marine Science Symposium (SAMSS). June 2022.
 62. Truter, M., Hadfield, K. A., Smit, N. J. 2022. Unique species diversity of *Quadriacanthus Paperna*, 1961 (Monogenea) from the African sharptooth catfish, *Clarias gariepinus* (Burchell) in Southern Africa. 15th International Congress of Parasitology, Copenhagen, Denmark (online presentation). August 2022.
 63. Truter, M., Hadfield, K. A., Smit, N. J. 2022. The role of environmental variables in metazoan parasitic community composition of *Clarias gariepinus* (Burchell) in the Vaal-Orange system, South Africa. 4th International Congress on Parasites of Wildlife and 50th Annual Conference of the Parasitological Society of Southern Africa, Skukuza. September 2022.
 64. van Beuningen, D., Bennett, R., Bernard, A., Siteo, J., Markovina, M., Fernando, S., Sidat, N., Oddenyo, R., Juby, R., Davids, A., Heckendorn, K. & da Silva, I. 2022. Informing improved conservation and management of elasmobranchs in the Western Indian Ocean: insights from baited remote underwater video surveys. Sharks International, Valencia. October 2022.
 65. van der Walt., K-A., Porri, F., Potts, W., Duncan, M. & James, N.C. 2022. How do selected organisms from a warm-temperate coastal ecosystem respond to the effects of climate change? 17th South African Marine Science Symposium (SAMSS). June 2022.
 66. van der Walt K., Potts, W.M., Porri, F., Winkler, A.C., Duncan, M.I., Skeeles, M.R., James, N.C. 2022. Too hot to handle? The effects of marine heatwaves on adult sparidfish (*Diplodus capensis*, Smith 1884) cardiac thermal limits in a temperate African coastal region. Poster presentation. 17th South African Marine Science Symposium (SAMSS). June 2022.
 67. van der Walt K., Potts, W.M., Porri, F., Winkler, A.C., Duncan, M.I., Skeeles, M.R., James, N.C. 2022. Projected impacts of climate change and vulnerability of coastal species in a warm-temperate African region. Ocean Sciences Meeting. March 2022.
 68. van der Walt, K., Reddy, S., Patrick, P. & Porri, F. 2022. Evaluating resiliency of nature-based eco-engineered structures and early life stages of organisms in a southern African urban coastal system under an era of climate change. Estuarine Coastal and Shelf Science Association (ECSA) Conference, San Sebastian, Spain. September 2022.
 69. van der Walt, K., Patrick, P., Reddy, S., Porri, F., 2022. Durability evaluation of nature-based eco-engineered structures and resiliency of early life stages of organisms within a southern African urban coastal system. The 12th Western Indian Ocean Marine Science Association (WIOMSA) scientific symposium. October 2022.
 70. von der Meden, C., Patrick, P., Van der Heever, G., Wozniak, D., Porri, F., Atkinson, I., Filander, Z., Madjit, P., Levin, I. & Sink, K. 2022. Quantifying Complex Biogenic Habitat Provided By *Thouarella* spp. (octocorallia), and The Incidence of Associate Taxa 17th Southern Africa Marine Science Symposium (SAMSS). June 2022.
 71. Wanda T.F., Wiles E.A., Cawthra H.C. & de Wit, A 2022. Multibeam bathymetry as the baseline for marine research: application in marine habitat mapping, South Africa. GeoHab Conference. May 2022.
 72. Wanda T.F., Wiles E.A., Cawthra H.C. & de Wit A.,

2022. The Value of Multibeam Bathymetry Data In Marine Spatial Initiatives. Southern African Marine Science Symposium (SAMSS). June 2022.
73. Wanda T.F., Wiles E.A., Cawthra H.C. & de Wit A., 2022. From singlebeam to multibeam echo-

sounders: the first systematic hydroacoustic survey within the Thukela marine protected area. Western Indian Ocean Marine Science Symposium. October 2022.

Seminar and workshop presentations

1. Bernard, A. 2022. Use of AI in underwater visual census research (of fish). SAMSS Workshop: Computervision 2022. June 2022.
2. de Necker, L. 2022. Schistosomiasis distribution and what people know: A South African perspective. Seminar for the KU Leuven Sustainable Development Living Lab field excursion in Ndumo Game Reserve, KZN. September 2022.
3. Elston, C. 2022. Making scientists more human and science more relatable. University of Fort Hare Virtual Science Communication Workshop. Invited workshop speaker. March 2022 (online).
4. Elston, C. 2022. Diamond and duckbill rays in the Breede Estuary. Breede Estuary Working Conservation Group Seminar. Online. September 2022.
5. Khosa, D. 2022. Biodiversity in space and time. Grade 10 Virtual Science Camp, NRF-SAEON, February 2022.
6. Murray, T. 2022. Science communication: The ins and outs of social media. Science Communication workshop (University of Fort Hare, BSc Honours). March 2022. Murray, T. 2022. Food security. Lecture to Epworth Grade 11 Life Science students. October 2022.
7. Porri, F., 2022. Overview of the IMIsEE Project. Indigenous Marine Innovations for Sustainable Environments and Economies (IMIsEE) Imbizo, Hamburg. August 2022.
8. Porri, F., Patrick, P., Human, L., McConnachie, B., Puccinelli, E., Betani, N., Howse, M., Mvubu, C., Cotiyane-Pondo, van der Walt, K.-A. & Wynberg, R. 2022. Nature-based solutions for urban coastlines. Italy-South Africa bilateral workshop on "Green solutions and marine biodiversity for a sustainable blue growth". Nelson Mandela University. December 2022.
9. van der Walt, K-A. 2022. Presentation and Poster Guidelines, Face-to face and virtually. Science Communication workshop (University of Fort Hare BSc Honours). March 2022.
10. van der Walt, K. 2022. Durability of Imizi grass material and structures in seawater. Indigenous Marine Innovations for Sustainable Environments and Economies (IMIsEE) Imbizo, Hamburg, Eastern Cape. August 2022.

Public presentations

1. Bernard, A. 2022. Seeing is believing: Observation based research strengthens the case for MPAs. World MPA day. August 2022.
2. Bills, R. 2022. Lake Tanganyika - catfish research and conservation. Penn State University, USA. October 2022.
3. Bragança, P.H. N. 2022. Disentangling the diversity of the African Lampeyes: a multidisciplinary approach. School of Biology Seminar, Leeds University, UK. March 2022.
4. Bragança, P.H.N., Burns, M.D. 2022. Body Size Evolution in Neotropical Freshwater fishes: the ecology of miniature species. XXIV Encontro Brasileiro de Ictiologia, Gramado, Brazil, September 2022 (online).
5. Braganca, P. H. N. 2022. Disentangling the evolution of the African Lampeye fishes: a multidisciplinary approach. NRF-SAIAB Seminar Series: Webinar. June 2022.
6. Chakona A, Skelton PH, Swartz ER, Braganca P. 2021. A biodiversity hotspot heats up: at least 12 new species of *Galaxias* from the Cape Fold Ecoregion. A public seminar presentation organized by the Grootvadersbosch Conservancy, Barrydale. April 2022.
7. Edworthy C. 2022. pH variability in Algoa Bay: a future monitoring site for ocean acidification. National Marine Week public lecture (online). August 2022.
8. Elston, C. 2022. What lives in the Keurbooms Estuary? Plett Ocean Festival. July 2022.
9. Elston, C. 2022. Become a citizen scientist and help save sharks. Plett Ocean Festival. July 2022.
10. Elston, C. 2022. Science on my doorstep: What lives in the Keurbooms Estuary? NRF-SAIAB Seminar Series: Webinar. August 2022.
11. Firth, L. 2022. Limpets in our Lives NRF-SAIAB Seminar Series: Webinar. July 2022.
12. James, N.C. 2022. A seascape of fish nursery habitats in Algoa Bay. NRF-SAEON National Science Week mini-symposium. August 2022 (online).
13. Knights, A. 2022. Assessing ecological networks: A primer for diversity and distribution NRF-SAIAB Seminar Series: Webinar. July 2022.
14. Mpanza, N. 2022. Alien vs native tilapia in South Africa: What does this mean for the native Mozambique tilapia? NRF-SAIAB Seminar Series: Webinar. August 2022.
15. Mukhari, D. 2022. Alien species management: Can acoustic telemetry data be used to optimise catch rates of invasive common carp in South Africa? NRF-SAIAB Seminar Series: Webinar. August 2022.
16. Murray, T. 2022. Shallow Marine and Coastal Research Infrastructure presentation on being an NRF-SAIAB-SMCRI scientist. SMCRI Evaluation Panel visit. September 2022.
17. Oliver, J. 2022. Using cutting-edge molecular tools to detect and monitor elusive marine fishes. NRF-SAIAB Seminar Series: Webinar. November 2022.
18. Padare, G. 2022. Estuary monitoring: Pondoland Marine Protected Area. NRF-SAIAB Seminar Series: Webinar. November 2022.
19. Pegg, J. 2022. Invasive species in tropical wetlands. Brunel University, London. March 2022 (online).
20. Truter, M. 2022. The incomplete story of the metazoan parasite communities of native and invasive *Clarias gariepinus* (Burchell) in South Africa. NRF-SAIAB Seminar Series: Webinar. October 2022.

Appendix B: NRF-SALAB RESEARCH DIVISION 2022

RESEARCH AND MANAGEMENT STAFF

<i>Name</i>	<i>Position</i>
Dr A.W. Paterson, PhD (Rhodes University)	Managing Director
Prof. P.D. Cowley, PhD (Rhodes University)	Principal Scientist
Dr A. Chakona, PhD (Rhodes University)	Senior Scientist (Science Leadership)
Prof. N.C. James, PhD (Rhodes University)	Senior Scientist (Science Leadership)
Prof. F. Porri, PhD (Rhodes University)	Senior Scientist (Science Leadership)
Dr A.T.F. Bernard, PhD (Rhodes University)	MARIP Instrument Scientist
Dr T.S. Murray PhD (Rhodes University)	ATAP Instrument Scientist
Dr E.A. Wiles, PhD (University of KwaZulu-Natal)	GeMAP Instrument Scientist
Dr G.F. Matcher, PhD (Rhodes University)	AGRP Instrument Scientist
Dr W. Coetzer, PhD (University of KwaZulu-Natal)	Biodiversity Information Manager
Mr I.R. Bills, MSc (Rhodes University)	Senior Curator
Mr D.N. Mazungula, MSc (Rhodes University)	Collections Manager
Mr R. Palmer, MSc (Rhodes University)	ACEP Technical & Scientific Manager
Mr T. Eriksen, BSc (UNISA)	ACEP Marine Technician
Mr K. Smith	ACEP Marine Technician
Mr M. Parkinson, MSc (Rhodes University)	ATAP Instrument Technician
Ms S. Reddy, BSc Hons (Rhodes University)	Ecophysiology Laboratory Co-ordinator
Mr F. Jacobs	Marine Field Assistant
Mr Thabo Mbuyazi	Coastal Craft Deckhand
Mr Lishini Kokose	General Assistant
Mrs V.T.J. Rouhani, MSc (Rhodes University)	Research Support Administrator

POST-DOCTORAL SCIENTISTS

<i>Name</i>	<i>Primary study area</i>	<i>Institute collaborator</i>
Dr P. de Bragança	Freshwater taxonomy	Dr A. Chakona
Dr L. de Necker	Freshwater ecology	Dr A. Chakona
Dr C. Edworthy	Ecology, eco-physiology, climate change	Prof. N. James
Dr C. Elston	Fish movement studies	Dr T. Murray
Dr R-L. Gibb	Algal bloom studies in estuarine ecosystems	Dr G. Matcher
Dr D. Khosa	Invasions and freshwater ecology	Dr A. Chakona
Dr M. Magoro	Invasions and freshwater ecology	Dr A. Chakona
Dr L. Mofu	Invasions and freshwater ecology	Dr A. Chakona
Dr P. Ndaleni	Ecology	R. Bills
Dr P. Nodo	Coastal and estuarine ecology	Prof. N. James
Dr J. Pegg	Invasions and freshwater ecology	Dr A. Chakona
Dr F. Phaka	Conservation and ecology (frogs, reptiles)	Dr A. Chakona
Dr M. Truter	Invasions and freshwater ecology	Dr A. Chakona
Dr K-A. van der Walt	Larval ecology	Prof. F. Porri
Dr R. Welch	Coastal and estuarine ecology	Prof. N. James

HONORARY RESEARCH ASSOCIATES

<i>Name</i>	<i>Status</i>
Dr E. Anderson, PhD (College of William & Mary)	Curator Emeritus
Dr R. Bennett, PhD (Rhodes University)	Honorary Research Associate
Dr M. Bruton, PhD (Rhodes University)	Honorary Research Associate
Dr R. Chalmers, PhD (Rhodes University)	Honorary Research Associate
Prof. A. Channing, PhD (Natal University)	Honorary Research Associate
Mr W. Conradie, MSc (North West University)	Honorary Research Associate
Dr R. Cuthbert, PhD (Queen's University of Belfast/University of Reading)	Honorary Research Associate
Dr T. Dalu, PhD (Rhodes University)	Honorary Research Associate
Dr R. Daly, PhD (Rhodes University)	Honorary Research Associate
Prof. R. Dorrington PhD (University of Cape Town)	Honorary Research Associate
Prof. L. du Preez, PhD (University of the Free State)	Honorary Research Associate
Dr D. Ebert, PhD (Rhodes University)	Honorary Research Associate
Dr B. Ellender, PhD (Rhodes University)	Honorary Research Associate
Dr J. Filmalter, PhD (Rhodes University)	Honorary Research Associate
Dr E. Gennari, PhD (Rhodes University)	Honorary Research Associate
Dr Jessica Glass, PhD (Yale University)	Honorary Research associate
Mr O. Gon, MSc (University of Jerusalem)	Curator Emeritus
Dr G. Gouws, PhD (University of Stellenbosch)	Honorary Research Associate
Dr J.S. Hargrove, PhD (University of Florida)	Honorary Research Associate
Mrs E. Heemstra, Dip. Ed. (University of Rhodesia)	Honorary Research Associate
Dr E. Heyns-Veale, PhD (Rhodes University)	Honorary Research Associate
Dr J. Hill, PhD (Rhodes University)	Honorary Research Associate
Mr W. Holleman, MSc (Rhodes University)	Honorary Research Associate
Dr J. Jackson, PhD (University of British Columbia)	Honorary Research Associate
Dr M. Jackson, PhD (Queen Mary University of London)	Honorary Research Associate
Dr F. Jacobs, PhD (University of KwaZulu-Natal)	Honorary Research Associate
Dr H. James, PhD (Rhodes University)	Honorary Research Associate
Dr M. Jordaan, PhD (Stellenbosch University)	Honorary Research Associate
Prof. W. Kadye, PhD (Rhodes University)	Honorary Research Associate
Mr D. King, Pr Eng (Ewell Technical College)	Honorary Research Associate
Dr A. Kock, PhD (University of Cape Town)	Honorary Research Associate
Dr M. Lipinski, DSc (University of Lodz)	Honorary Research Associate
Prof. N. Mandrak, PhD (University of Toronto)	Honorary Research Associate
Dr S. Marr, PhD (University of Cape Town)	Honorary Research Associate
Dr M. Martin, PhD (Australian Maritime College/University of Tasmania)	Honorary Research Associate
Dr T. Miya, PhD (Rhodes University)	Honorary Research Associate
Dr T.F. Næsje, DSc (University of Trondheim)	Honorary Research Associate
Dr S. Parker-Nance, PhD (Nelson Mandela University)	Honorary Research Associate
Dr R. Peel, PhD (Rhodes University)	Honorary Research Associate
Prof. W. Potts, PhD (Rhodes University)	Honorary Research Associate
Prof. P. Psomadakis, PhD (Polytechnic University of Marche)	Honorary Research Associate
Dr U. Schliewen, PhD (Ludwigs-Maximilians-University)	Honorary Research associate
Prof. P. Skelton, PhD (Rhodes University)	Managing Director Emeritus
Dr M. Smale, PhD (Rhodes University)	Honorary Research Associate
Dr J. South, PhD (Queens University Belfast)	Honorary Research Associate
Dr J. Stauffer, PhD (Blackburg State University)	Honorary Research Associate
Prof. N. Strydom, PhD (Rhodes University)	Honorary Research Associate
Dr M. Tagliarolo, PhD (Université de Bretagne Occidentale)	Honorary Research Associate
Dr G. Taylor, PhD (Rhodes University)	Honorary Research Associate
Dr J. Taylor, PhD (North-West University)	Honorary Research Associate
Mr D. Tweddle, BSc (University of Wales)	Honorary Research Associate
Dr F. Uiblein, PhD (University of Vienna)	Honorary Research Associate
Dr S. Viana, PhD (University of São Paulo)	Honorary Research Associate
Dr E. Vreven, PhD (KU Leuven)	Honorary Research Associate
Dr R. Wasserman, PhD (Rhodes University)	Honorary Research Associate
Prof. A. Whitfield, PhD (University of Natal) DSc (Rhodes University)	Chief Scientist Emeritus
Dr D. Woodford, PhD (University of Canterbury)	Honorary Research Associate

NRF-SAIAB SUPERVISED STUDENTS GRADUATED IN 2022

<i>Name</i>	<i>Degree</i>	<i>Higher Education Institution</i>	<i>Supervisor</i>
Mr R. Dixon	MSc	Rhodes University	Prof. P. Cowley, Dr T. Murray
Mr A. Jacobs	MSc	Nelson Mandela University	Prof. N. James
Ms T. Kgomokhumo	MSc	Rhodes University	Dr G. Matcher
Ms B. Mataboge	MSc	Rhodes University	Dr A. Bernard, Prof. N. James
Ms N. Matam	MSc	Rhodes University	Dr J. South, Dr G. Thondhlana
Ms T. Mkhize	MSc	Nelson Mandela University	Prof. N. James
Ms N. Mpanza	MSc	Rhodes University	Dr J. Pegg, Prof. O. Weyl
Ms D. Mukhari	MSc	Rhodes University	Dr J. Pegg, Prof P. Cowley, Prof. O. Weyl
Ms T. Nkomo	MSc	Rhodes University	Dr A. Chakona
Mr G. Padare	MSc	University of Fort Hare	Prof. P. Cowley, Dr T. Murray
Mr J. Pearson	MSc	North West University	Dr L. de Necker
Ms H. Rama	MSc	WITS University	Dr J. Pegg, Prof. O. Weyl
Ms S. Reddy	MSc	Rhodes University	Prof. F. Porri
Mr C. Rennie	MSc	Rhodes University	Dr A. Chakona
Mr C. Broom	PhD	Rhodes University	Dr J. South, Prof. O. Weyl
Mr C. Muller	PhD	Rhodes University	Prof. N. James
Ms P Ndaleni	PhD	Rhodes University	Prof. N. James
Ms P. Nodo	PhD	Rhodes University	Prof. N. James
Mr P. Swanepoel	PhD	University of Free State	Dr J. Pegg
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Appendix C: Acronyms, Abbreviations, Definitions

ABC	Agulhas Bank Connections	NM	Nautical Miles
ACEP	African Coelacanth Ecosystem Programme	NMU	Nelson Mandela University
AERP	Aquatic Ecophysiology Research Platform	NOAA	National Oceanic & Atmospheric Administration
AES	American Elasmobranch Society	NPs	Marine Natural Products
AGRP	Aquatic Genomics Research Platform	NRF-FBIP	National Research Foundation - Foundational Biodiversity Information Programme
AIS	Alien Invasive Species	NRF-SAEON	National Research Foundation - South African Environmental Observation Network
ATAP	Acoustic Tracking Array Platform	NRF-SAIAB	National Research Foundation - South African Institute for Aquatic Biodiversity
BHL	Biodiversity Heritage Library	NSCF	Natural Science Collection Facility
BRUVs	Baited Remote Underwater Video systems	NSI	National System of Innovation
CBD	Convention on Biological Diversity	NWU	North West University
CGS	Council for Geoscience	OA	Ocean Acidification
CMC	Collections Management Centre	OPAC	Online Public Access Catalogue
CoNCENSUS	Coastal & Nearshore CENSUS Techniques	ORI	Oceanographic Research Institute
CORDIO	Coastal Oceans Research & Development in the Indian Ocean	OTN	Ocean Tracking Network
COST	Coast & Ocean Sciences Team	PDP	Professional Development Programme
CPUT	Cape Peninsula University of Technology	quantitative PCR	quantitative Polymerase Chain Reaction
DETEA	Department of Economic Development, Tourism & Environmental Affairs	REFRESH	Renewing data & filling knowledge gaps for freshwater species of South Africa to inform species & ecosystem conservation
DFFE	Department of Forestry, Fisheries & Environment	RIRP	Research & Innovation Reward Programme
DIFS	Department of Ichthyology & Fisheries Science	ROV	Remotely Operated Vehicle
DSI	Department of Science & Innovation	RSG	Rufford Small Grants for Nature Conservation
DST	Department of Science & Technology (now DSI)	RU	Rhodes University
ECSA	Estuarine Coastal & Shelf Science Association	RUV	Remove Underwater Video camera
EDI	Equity, Diversity & Inclusion	RV	Research Vessel
eDNA	Environmental DNA	SAAMBR	SA Association for Marine Biological Research
EPA	Estuarine Protected Area	SAFER Lab	SA Fisheries Ecology Research Laboratory
FAO	Food & Agriculture Organisation	SALPA	South African Linefish Physiology Assessment
FBIP	Foundational Biodiversity Information Programme	SAMSS	Southern African Marine Science Symposium
GBIF	Global Biodiversity Information Facility	SANBI	South African National Biodiversity Institute
GeMAP	Geophysics & Mapping Platform	SARChI	South African Research Chairs Initiative
GIS	Geographic Information System	SASRS	South African Shark & Ray Symposium
GOA-ON	Global Ocean Acidification Observing Network	SBRUVs	Stereo-Baited Remote Underwater Video systems
GOOS	Global Ocean Observing System	SCOR	Scientific Committee on Oceanic Research
HDIs	Historically Disadvantaged Institutions	SDGs	Sustainable Development Goals
HICD	Human & Infrastructure Capital Development	SEALS	South East Academic Libraries System
HPPP	High Performance Physiological Phenotypes	SEaS	Seafloor Ecology & Sustainability
ICAIS	International Conference on Aquatic Invasive Species	SIDS	Small Isl& Developing States
IMIsEE	Indigenous Marine Innovations for Sustainable Environments & Economies	SMART	Specific, Measurable, Achievable, Relevant, Time-bound
IMR	Institute of Marine Research	SMCRI	Shallow Marine & Coastal Research Infrastructure
INOS	Institute Oseanografi dan Sekitaran (Institute of Oceanography & Environment)	sRUVs	Remote Underwater Stereo Video systems
IP	Intellectual Property	SU	Stellenbosch University
IRD	Institute of Research for Development (France)	SWIO	South West Indian Ocean
ISI	International Scientific Indexing	TK	Traditional Knowledge
IUCN	International Union for Conservation of Nature	TNPA	Transnet National Ports Authority
JMLP	Joint Marine Laboratories Programme	UCT	University of Cape Town
KZN	KwaZulu-Natal	UFH	University of Fort Hare
MARIP	Marine Remote Imagery Platform	UFS	University of Free State
MCEN	Marine & Coastal Educators Network	UJ	University of Johannesburg
MiSeq	An integrated instrument that performs clonal amplification, sequencing & data analysis in a single run	UKZN	University of KwaZulu-Natal
MoA	Memorandum of Agreement	UL	University of Limpopo
MoU	Memorandum of Understanding	UMP	University of Mpumalanga
MPA	Marine Protected Area	UNISA	University of South Africa
MPTA	Mpumalanga Tourism & Parks Agency	UNIZULU	University of Zululand
MRAC	Musée Royal Afrique Centrale (also known as RMCA - Royal Museum for Central Africa)	UP	University of Pretoria
NBA	National Biodiversity Assessment	UPLC	Ultra High Pressure Liquid Chromatography
NDP	National Development Plan	UWC	University of the Western Cape
NEKTON	A not-for-profit research foundation, working with the University of Oxford & a wide range of partners to accelerate the scientific exploration & protection of the oceans.	WIO	Western Indian Ocean
NEM:BA	National Environmental Management: Biodiversity Act	WIOMSA	Western Indian Ocean Marine Science Association
NFC	National Fish Collection	WIPO	World Intellectual Property Organisation
NFEPAs	National Freshwater Ecosystem Priority Areas	WITS	University of the Witwatersrand
NFSC	National Freshwater Snail Collection	WRC	Water Research Commission
		WSU	Walter Sisulu University
		WWF-SASSI	World Wide Fund -Southern African Sustainable Seafood Initiative



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