Above: MSc student, Siphelele Dyantyi, and Post Doc, Dr Paula Pattrick, deploy a plankton pump from the ACEP coastal research vessel, R/V uKwabelana, using a motorised winch. Principal Investigator, and NRF-SAIAB Senior Scientist, Dr Francesca Porri, looks on (Photo: Harold Marchand)

Front cover: Nkosinathi Mazungula, NRF-SAIAB Senior Curation Officer, setting a multi-mesh gill net fleet in the Cuanavale source lake, Angola, as part of a multidisciplinary taxonomic survey of the Okavango source region in south-eastern Angola (Photo: Ben van der Waal)

Editors: A.K. Whitfield, V.T.J. Rouhani, H.Holleman
Compilation: V.T.J. Rouhani

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NRF-SAIAB

ANNUAL RESEARCH REPORT

January – December 2017

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 the open, peer-reviewed literature in due course.
**NRF-SAIAB RESEARCH DIVISION 2017**

### RESEARCH AND MANAGEMENT STAFF

<table>
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<tr>
<th>Name and existing degree</th>
<th>Position</th>
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<tr>
<td>Dr A.W. Paterson, PhD (Rhodes University)</td>
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<td>Prof. P.D. Cowley, PhD (Rhodes University)</td>
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<td>Prof. O.L.F. Weyl, PhD (Rhodes University)</td>
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<tr>
<td>Mr D.N. Mazungula, BSc Hons (Rhodes University)</td>
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### POSTDOCTORAL SCIENTISTS

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<td>Dr R. Bennett</td>
<td>Fish telemetry studies</td>
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<td>Dr D. Woodford, PhD (University of Canterbury)</td>
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## POSTGRADUATE STUDENT PROJECTS SUPERVISED IN 2017

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<th>Institute supervisor or co-supervisor</th>
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<tr>
<td>Mr S. Avidon</td>
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<td>Dr S. Marr</td>
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<tr>
<td>Mr T. Bellingan</td>
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<td>Estuarine fish movements</td>
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<td>Ms R. Steyn</td>
<td>PhD</td>
<td>Methods research</td>
<td>Dr A. Bernard</td>
</tr>
<tr>
<td>Ms S. Talma</td>
<td>MSc</td>
<td>Fish population genetics</td>
<td>Prof. P. Cowley</td>
</tr>
<tr>
<td>Ms J. Trassierra</td>
<td>MSc</td>
<td>Dynamics of ichthyoplankton</td>
<td>Dr F. Porri &amp; Dr P. Pattrick</td>
</tr>
<tr>
<td>Ms M. Truter</td>
<td>MSc</td>
<td>Invasion biology</td>
<td>Prof. O. Weyl</td>
</tr>
<tr>
<td>Ms K-A. van der Walt</td>
<td>PhD</td>
<td>Climate change</td>
<td>Dr N. James &amp; Dr F. Porri</td>
</tr>
<tr>
<td>Mr A. van Wyk</td>
<td>Hons</td>
<td>Methods research</td>
<td>Dr A. Bernard</td>
</tr>
<tr>
<td>Mr R. van Zeeventer</td>
<td>MSc</td>
<td>Fish taxonomy</td>
<td>Mr R. Bills</td>
</tr>
<tr>
<td>Mr L. Vorsatz</td>
<td>PhD</td>
<td>Mangrove ecology</td>
<td>Dr F. Porri</td>
</tr>
<tr>
<td>Mr R. Watson</td>
<td>PhD</td>
<td>Behavioural ecology</td>
<td>Prof. P. Cowley</td>
</tr>
<tr>
<td>Mr S. Weerts</td>
<td>PhD</td>
<td>Estuarine fish ecology</td>
<td>Prof. A. Whitfield</td>
</tr>
<tr>
<td>Mr S. Yokwana</td>
<td>MSc</td>
<td>Marine fish population genetics</td>
<td>Dr G. Gouws</td>
</tr>
<tr>
<td>Ms A. Zonda</td>
<td>MSc</td>
<td>Deep-sea fishes</td>
<td>Dr A. Bernard</td>
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### NRF-SAIAB SUPERVISED STUDENTS GRADUATING IN 2017

<table>
<thead>
<tr>
<th>Student name</th>
<th>Degree</th>
<th>Primary study area</th>
<th>Institute supervisor or co-supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr M. Bakane</td>
<td>MSc</td>
<td>Fisheries</td>
<td>Prof. O. Weyl</td>
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<td>Ms L. Cele</td>
<td>MSc</td>
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<td>Dr G. Gouws</td>
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<td>Ms G. Diedricks</td>
<td>PhD</td>
<td>Invasion biology</td>
<td>Prof. O. Weyl</td>
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<tr>
<td>Ms C. Edworthy</td>
<td>MSc</td>
<td>Fish physiology</td>
<td>Dr N. James</td>
</tr>
<tr>
<td>Mr G. Grant</td>
<td>MSc</td>
<td>Fish movements</td>
<td>Prof. P. Cowley &amp;</td>
</tr>
<tr>
<td></td>
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<td>Prof A. Whitfield</td>
</tr>
<tr>
<td>Ms S. Halse</td>
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<td>Dr A. Bernard</td>
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<td>Ms R. Juby</td>
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<td>Behavioural ecology</td>
<td>Dr A. Bernard</td>
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<tr>
<td>Ms Z. Khundulu</td>
<td>MSc</td>
<td>Marine biochemistry</td>
<td>Dr A. Paterson</td>
</tr>
<tr>
<td>Mr B. Mann</td>
<td>PhD</td>
<td>Coastal fisheries</td>
<td>Prof. P. Cowley</td>
</tr>
<tr>
<td>Ms N. Matam</td>
<td>Hons</td>
<td>Larval ecology</td>
<td>Dr F. Porri &amp; Dr P. Patrrick</td>
</tr>
<tr>
<td>Ms N. Mbandzi</td>
<td>MSc</td>
<td>Estuarine ecology</td>
<td>Prof. A. Whitfield &amp;</td>
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<tr>
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<td>Dr R. Wasserman</td>
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<tr>
<td>Ms T. Murray</td>
<td>PhD</td>
<td>Fish movements</td>
<td>Prof. P. Cowley</td>
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<tr>
<td>Ms S. Mvunelo</td>
<td>Hons</td>
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<td>Dr F. Porri &amp; Dr P. Patrrick</td>
</tr>
<tr>
<td>Ms P. Ndaleni</td>
<td>MSc</td>
<td>Fish invasions</td>
<td>Prof. O. Weyl</td>
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<td>Ms S. Ockhuis</td>
<td>MTech</td>
<td>Meroplankton genetics</td>
<td>Dr G. Gouws</td>
</tr>
<tr>
<td>Mr R. Peel</td>
<td>PhD</td>
<td>River ecosystem ecology</td>
<td>Prof. O. Weyl</td>
</tr>
<tr>
<td>Ms M. Pollard</td>
<td>MSc</td>
<td>Fish habitat utilisation</td>
<td>Prof. A. Whitfield</td>
</tr>
<tr>
<td>Mr M. Ramoejane</td>
<td>PhD</td>
<td>Fish genetics</td>
<td>Prof. O. Weyl</td>
</tr>
<tr>
<td>Ms D. Sifundza</td>
<td>Hons</td>
<td>Aquatic ecology</td>
<td>Dr A. Chakona</td>
</tr>
<tr>
<td>Ms A. Zonda</td>
<td>Hons</td>
<td>Freshwater systematics</td>
<td>Dr A. Chakona &amp; Mr R. Bills</td>
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<table>
<thead>
<tr>
<th>SAIAB Staff</th>
<th>Contract/Consultancy</th>
<th>Primary Client/ Funding Organisation</th>
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<tr>
<td>Bernard, A.T.F.</td>
<td>Development of sampling technologies to survey deep reef fish assemblages</td>
<td>NRF RTF</td>
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<td>Bernard, A.T.F.</td>
<td>Structure and condition of South Africa’s high latitude coral reefs</td>
<td>iSimangaliso Wetland Park, Global Finprint project</td>
</tr>
<tr>
<td>Bernard, A.T.F.</td>
<td>Assessment of elasmobranch populations in Madagascar</td>
<td>Wildlife Conservation Society</td>
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<tr>
<td>Cowley, P.D.</td>
<td>ATAP: Monitoring movements of marine animals</td>
<td>Save Our Seas Foundation (SOSF)</td>
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<td>Cowley, P.D.</td>
<td>Spatial ecology of fishes at St Joseph Atoll, Seychelles</td>
<td>SOSF</td>
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<td>Cowley, P.D.</td>
<td>Estuarine fish movements and habitat connectivity</td>
<td>SANCOOP SA/Norway bilateral - NRF &amp; Norwegian Research Council (NRC)</td>
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<td>Gouws, G.</td>
<td>SeaKeys: Unlocking foundational biodiversity information</td>
<td>South African National Biodiversity Institute (SANBI)/NRF-FBIP</td>
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<td>Tweddle, D. &amp; Weyl, O.L.F.</td>
<td>SASSCAL Task 166: Improved knowledge of aquatic ecosystems supporting fisheries, development of integrated strategies for sustainable fisheries and improved fisheries management</td>
<td>Southern African Science Service Centre for Climate Change and Adaptive Land Management</td>
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<td>Weyl, O.L.F.</td>
<td>Monitoring of the impact and recovery of the biota of the Rondegat River after the removal of alien fishes</td>
<td>Water Research Commission, South Africa</td>
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<td>Weyl, O.L.F.</td>
<td>Input into National Invasive Species Strategy and Action Plan for the Department of Environmental Affairs</td>
<td>Council for Scientific and Industrial Research (CSIR), South Africa</td>
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<td>Weyl, O.L.F.</td>
<td>Lake Niassa freshwater reserve monitoring, Mozambique</td>
<td>World Wide Fund for Nature</td>
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The following internationally funded collaborations were undertaken by SAIAB staff during 2017.

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<tr>
<th>SAIAB Staff</th>
<th>Project</th>
<th>Funding Organisation</th>
<th>Country</th>
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<tr>
<td>Bernard, A.T.F.</td>
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<td>Australia</td>
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<td>Bernard, A.T.F.</td>
<td>Assessment of elasmobranch populations in Madagascar</td>
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<td>Cowley, P.D.</td>
<td>Spatial and trophic ecology of fishes in Seychelles</td>
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<td>Cowley, P.D.</td>
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<td>Bills, R., Adam, Z., Bodill, T.</td>
<td>Barcode of Wildlife project</td>
<td>CBOL/SANBI - Google Global Impact award</td>
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<td>Porri, F.</td>
<td>Physiology of larvae</td>
<td>NRF</td>
<td>Hong Kong</td>
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<td>Porri, F.</td>
<td>Field course in Aquatic Biology</td>
<td>NRF</td>
<td>Italy, Hong Kong, Germany</td>
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<td>Porri, F.</td>
<td>Benthic-pelagic mechanisms of inshore coastal waters</td>
<td>NRF</td>
<td>Canada</td>
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<td>Weyl, O.L.F.</td>
<td>Assessing impacts and benefits of alien fish introductions</td>
<td>Wageningen</td>
<td>Netherlands</td>
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<td>Weyl, O.L.F. &amp; Tweddle, D.</td>
<td>Zambezi region floodplain fisheries</td>
<td>NedBank, Namibia Nature Foundation (NNF), University of Namibia, SASSCAL</td>
<td>Namibia, Zambia, Botswana</td>
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<td>Weyl, O.L.F.</td>
<td>Centrarchid fisheries and impacts</td>
<td>SAIAB/University of Florida</td>
<td>USA</td>
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- **16. Assessing Nursery Habitats for Estuary-Associated Fish Species**
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### APPENDIX 1

- **NRF-SAAB Research Outputs (2017)**
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- **Books, Book Chapters and Book Reviews**
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### APPENDIX 2

- **List of Acronyms**
RESEARCH HIGHLIGHTS

The NRF-SAIAB Research Division continues to break historic institutional records in terms of postgraduate students supervised and annual research outputs, especially the number of ISI-rated publications. Altogether 10 BSc Honours, 32 MSc and 25 PhD projects were undertaken in 2017 (see pages iv to v for details), a fine achievement by a staff of only eight full-time scientists and a small cohort of postdocs. In addition, 20 students received their postgraduate degrees in 2017 (see page vi for details) during graduation ceremonies at a variety of South African universities. Of a total of 27 projects/programmes conducted in 2017, 14 were linked primarily to the Molecular Biology and Systematics focus and 13 dealt mainly with Conservation Biology and Ecology issues (see page ix for titles).

The Acoustic Tracking Array Platform (ATAP) continues to show growth in terms of the number and diversity of animals tagged with acoustic transmitters in southern African coastal waters. The ATAP also featured on the front cover of African Journal Marine Science (Volume 39:4) and included an article by Prof. Paul Cowley and his team that reflected on the first five years of this internationally recognised research platform. NRF-SAIAB’s biotelemetry researchers initiated two exciting new projects in 2017. The first, in collaboration with researchers from ORI, aims to unravel one of David Attenborough’s Blue Planet mysteries on giant kingfish that frequent the Mtentu Estuary. The other addresses a knowledge gap on the movement ecology and migrations of several stingray species, including duckbill, diamond and blue stingrays.

Prof. Alan Whitfield is nearing retirement and two of his MSc students, Nokubonga Mbhandzi, who investigated the link between river flow and the abundance of two zooplanktivorous fish species in the Kariega Estuary, and Melissa Pollard, who studied the use of different types of littoral habitats by fishes in the Knysna Estuary using an underwater GoPro camera, successfully submitted their theses during the year. Mandla Magoro is busy writing up his PhD on the ecology of Eastern Cape coastal micro-outlets and micro-estuaries, and he will be handing in his thesis for examination in the first half of 2018. Prof. Whitfield published a number of important global and local review papers on fishes in estuaries during the year and is far advanced with a revision of his 1998 monograph on the biology and ecology of fishes in southern African estuaries, a major work that will be published in the second half of 2018.

Dr Nikki James and her research team continued their research into the impact of climate change (extreme events, pH and temperature) and exploitation on fish communities and the relative value of different nursery habitats for coastal and estuarine fish species. This research expanded into the inshore areas of Algoa Bay, with two PhD students, Phakama Nodo and Carla Edworthy, starting their PhD projects in 2017. Phakama is assessing the use of nearshore and estuarine nursery habitats by early juvenile demersal fish species in Algoa Bay and Carla is monitoring ocean acidification in the Bay and looking at how life history determines the response of fish species to ocean acidification. A highlight for the year was the team delivering seven presentations at the South African Marine Science Symposium, with two students, Bernard Erasmus and Carla Edworthy, being awarded first and second prizes, respectively, for the best student presentations.

Notable progress in the development of deep-water baited remote underwater stereo-video systems (stereo-BRUVs) under the leadership of Dr Anthony Bernard was achieved in 2017. These BRUVs can be used to survey benthic and demersal fishes from the outer edges of the continental shelf down into the bathyal zone. Firstly, successful fish community surveys of the Wright Canyon and the adjacent shelf edge and slope were undertaken in the iSimangaliso Wetland Park marine protected area. Calm oceanic conditions allowed for sampling between depths of 70 and 250 m, using traditional stereo-BRUVs, and revealed diverse fish assemblages dominated by very large serranid and sparid fish. Secondly, funding received from the NRF Research and Technology Fund made it possible to develop and successfully test an untethered stereo-BRUV (i.e. one that does not have ropes connecting it to buoys on the sea surface) capable of working down to a depth of 1110 m. The untethered stereo-BRUV uses a built-in ballast system, controlled by remotely operated acoustic-release transponders and syntactic foam buoyancy to control its ascent and descent from the seafloor. This new technology facilitates research in more challenging marine environments and greatly broadens the scope for future deep-sea research at NRF-SAIAB and in South Africa.

During 2017, research on larval ecology by the Coastal and Ocean Sciences Team (COST) led by Dr Francesca Porri has focused on mainly two systems: coastal environment rocky shores (natural and man-made) and mangroves. Larval distribution and settlement/recruitment of invertebrates has been investigated in relation to prevailing winds, under the broader project funded by the African Coelacanth Ecosystem Programme (ACEP) on the pathways of larval dispersal. The role of mangrove microhabitats as nurseries for fish and invertebrate larvae is also one of the main projects initiated during 2017. Most samples have been collected and laboratory
analyses are currently underway. Physiological experiments on larval metabolism have been initiated, while bacterial metabolism from mangrove substrates are also being investigated. In addition, the population and organism-based research described above has been complemented by DNA barcoding analyses of fish larvae from nearshore waters.

The major research focus for Dr Gavin Gouws during 2017 was the study of phylogeography and diversity of freshwater crabs in the under-sampled eastern part of South Africa, supported by the extension of an NRF-CPRR programme. Research investigating the connectivity of marine fishes between the east coast of South Africa and Madagascar on the ACEPIII Suitcase Project was concluded, with new projects incorporating estuarine fishes being initiated. The large collaborative FBIP “SeaKeys; Unlocking Foundational Marine Biodiversity Knowledge” programme, under which NRF-SAIAB led the DNA barcoding, drew to a close. Collaborative research on goatfish systematics and taxonomy with Dr Franz Uiblein continued through 2017. In terms of students, Bruce McClure and Frankie de Beer both registered to continue their research on freshwater crabs, as did Martinus Scheepers with his MSc on paternity and mating strategies in clinid fishes. Yonela Sithole submitted a successful MSc thesis on the systematics of the undulated moray eel (*Gymnothorax undulatus*), and Sibusiso Yokwana started an MSc study on the genetic stock structure of blue bream (*Pachymetopon aeneum*). Four papers and numerous conference presentations, including some at international symposia resulted from this work. Two new projects, in which Gavin was a key co-investigator, were successfully funded: an NRF-FBIP supported project (in collaboration with the University of Pretoria and SAAMBR-ORI) aims to construct a DNA barcode library for all exploited linefishes in South African waters, while the CAPTOR project is looking at connectivity between existing and proposed MPAs along the South African east coast.

Prof. Olaf Weyl’s research produced 33 papers, one book chapter and graduated five PhD and three MSc students. Research successes were in the three core areas: conservation biology, invasions, freshwater ecology and inland fisheries. A paper in the journal *Conservation Biology* highlighted the role of man-made impoundments as refugia for native fishes in water-stressed regions. This role is becoming progressively more important as the increasing demands on water can result in complete dewatering of rivers during water-stressed periods, such as the current drought in the Western Cape. The group also published a review of the biology and status of Cape Fold Ecoregion freshwater fishes in the journal *Aquatic Conservation: Marine and Freshwater* which will provide a basis for directing future research and conservation efforts in this important biodiversity hotspot. In the field of invasion biology, the research group contributed to the development of a new metric to understand and predict the ecological impacts of existing, emerging and future invasive alien species. This metric is the result of a global collaboration of invasion biologists and shows great promise as a tool for predicting invasion impacts. On a policy scale, the invasion risk for freshwater fishes in South Africa was evaluated and a tool for optimising invasive fish management interventions in South Africa was developed. Two major reviews were also completed to better understand invasion status and impacts of brown trout and redclaw crayfish in Africa.

In the fields of freshwater ecology and inland fisheries, the works by PhD graduates Geraldine Taylor and Richard Peel have contributed to a better understanding of how to analyse and interpret food webs in the large floodplain ecosystems. Inland fisheries research has also progressed well and several research papers were published describing inland fisheries in South Africa, which created a better understanding of the link between low initial population sizes and the ultimate success of fishes that are important in fisheries. This research contributed to developing a better understanding of how to manage fisheries for species that also have a biodiversity impact.

During 2017, NRF-SAIAB and SANBI jointly coordinated the reassessment of the conservation status and extinction risk for all freshwater fishes of South Africa according to the latest IUCN Red List Categories and Criteria. A decision was made to include all recently identified genetic lineages in published literature, even before they are formally described, to guide the development and implementation of appropriate conservation management strategies. Each species assessment was reviewed by at least two experts to ensure that the IUCN criteria had been followed and applied correctly, and that all relevant information was presented.

During the year, researchers from Ezemvelo KZN Wildlife and NRF-SAIAB, led by Dr Albert Chakona, also documented the freshwater rediscovery of the century on the African continent following the discovery of the Maloti minnow, *Pseudobarbus quathlambae*, from the Mzimkhulu River in KwaZulu-Natal. This species was originally described based on specimens that were collected from the uMkhomazana River in KZN in 1938. However, subsequent surveys failed to find specimens of the Maloti minnow in the uMkhomazana or elsewhere in South Africa. The species was therefore declared extinct in South Africa. For a long time, extant populations of this species were considered to be confined to various streams in the Lesotho Highlands. The rediscovery of
the Maloti minnow after almost eighty years since the original collections were made from South Africa is significant, because it is the first record of the species from the Mzimkhulu River system. This confirms the assertion that this species is likely to have been previously widely distributed in the Drakensberg streams of KwaZulu-Natal prior to human impacts. The rediscovery of the Maloti minnow creates obligations and responsibilities for all parties involved, especially the conservation authorities responsible for the area, to implement measures that will prevent loss of this species in South Africa.

In conclusion, the productivity of NRF-SAIAB research staff, students, postdocs and Honorary Research Associates continued at a high level during 2017, with a record 116 ISI-rated scientific papers and four other peer-reviewed papers being published (see Appendix 1 for details). It was also a bumper year in terms of conference and symposium papers, with 91 being delivered at a wide variety of national and international venues. A decreasing number of contract and consultancy projects were undertaken by our research staff due to their increasing scientific involvement with postgraduate students and postdoctoral fellows. In addition to the above more formal activities, our scientists continue to communicate information about their research for use by managers, scholars and the wider public. This is evidenced by the 16 seminar and workshop presentations, 15 public presentations delivered, and 21 research-related popular articles produced by NRF-SAIAB staff during 2017 (see Appendix 1 for details).

Alan Whitfield
April 2018
MOLECULAR BIOLOGY & SYSTEMATICS

Molecular Biology & Systematics research at NRF-SAIAB focuses on the exploration and description of southern African aquatic biodiversity from a molecular to a community level.
1. SYSTEMATICS OF THE CARDINAL FISH FAMILY APOGONIDAE

Project leader: Mr O. Gon

Project researchers: Mr O. Gon, Dr G. Gouws

Project collaborators: Dr G.R. Allen, Dr M.V. Erdmann, Dr T. Alpermann, Mr S.V. Bogorodsky

Source of funds: NRF-SAIAB, NRF

Duration of project: 1983 – ongoing

BACKGROUND

Research on the South African species of cardinal fishes for Smiths’ Sea Fishes introduced Mr Gon to the taxonomic problems of the family Apogonidae. Evidence suggested that this widely distributed, speciose and ecologically important group is one of the least known among tropical reef fishes and was therefore urgently needed research.

OBJECTIVES

To resolve synonymies, describe new species, and elucidate phylogenetic relationships within the Apogonidae through a series of revisions of genera and subgenera.

PROGRESS

A new species from the Red Sea is being described in collaboration with colleagues from the Senckenberg Museum, Frankfurt, Germany. The study of the ontogeny of scales in the Apogonidae has been published.

FUTURE WORK

Continue with the revision of Apogon and research on the phylogeny for the Apogonidae.

SELECTED PUBLICATIONS/REPORTS


2. SYSTEMATICS OF SUB-ANTARCTIC NOTOTHENIOID FISHES

Project leader: Mr O. Gon
Project researchers: Mr O. Gon, Prof. C. Cheng, Dr T. Miya
Project collaborators: Dr C. von der Meden
Source of funds: NRF-SAIAB
Duration of project: 2004 – ongoing

BACKGROUND

Much new knowledge has been gained since the publication of *Fishes of the Southern Ocean*, but little was done during this period on the systematics of the notothenioid fishes in the sub-Antarctic region, particularly the species that also occur south of the Antarctic Polar Front. The International Collaborative Expedition to collect and study Fish Indigenous to sub-Antarctic Habitats (ICEFISH) was an international research initiative on the fishes of the Southern Ocean with special attention to the sub-Antarctic region. Mr Gon was invited to participate in the ICEFISH 2004 cruise as a Principal Investigator. The work that started on this cruise continued as a South African National Antarctica Programme (SANAP)-supported project employing molecular methods to research these fishes.

OBJECTIVES

1. To characterise the freezing avoidance attributes of sub-Antarctic notothenioid species and their possible use as taxonomic characters through a comparison with the attributes of continental Antarctic relatives.
2. To evaluate the taxonomic status of notothenioid species that occur in both the Antarctic and sub-Antarctic region.

PROGRESS

Recent underwater photographic surveys of the benthos of the Prince Edward Islands led to a collaboration with a researcher from NRF-SAEON. Mr. Gon was asked to identify the fish in photographs taken during visits to the islands in the period 2013–2017.

FUTURE WORK

A paper on the decline of *Notothenia coriiceps* at the Prince Edward Islands has been submitted. Research on freezing avoidance in notothenioid fishes and their taxonomy continues.

SELECTED PUBLICATIONS/REPORTS


3. SYSTEMATICS OF SELECTED MARINE FISHES: 1

Project leader: Dr M.E. Anderson
Project researcher: Dr M.E. Anderson
Source of funds: NRF, NRF-SAIAB
Duration of project: 1989 – ongoing

BACKGROUND

The suborder Zoarcoidei continues to be the main focus of my research since retirement in 2006. Additional research was begun on selected ophidiiforms (Bythitidae and Carapidae) and has been completed.

OBJECTIVES

The main focus for the immediate future includes regional descriptive reviews and new species descriptions.

PROGRESS

A new species of zoarcid was published in Zootaxa (see publication list below).

FUTURE WORK

Future work on the Zoarcidae needs to include analysis of the genus *Pachycara* from the Caribbean Sea. Descriptions of rare Indian Ocean deep-sea fishes are being prepared with colleague Dr Franz Uiblein from the Institute of Marine Research (IMR) in Bergen.

SELECTED PUBLICATIONS/REPORTS

4. SYSTEMATICS OF SELECTED MARINE FISHES: 2

Project leader: Mr W. Holleman

Project researchers: Mr W. Holleman, Dr D. Hoese, Mr S. Kang-Ning, Dr G. Gouws, Ms J. Glass

Source of funds: NRF

Duration of Project: 2004 – ongoing

BACKGROUND

Blennioid fishes are all marine and an important component of tropical and warm-temperate reef fauna worldwide, with a mere handful of species being found in cool temperate waters (particularly in southern New Zealand). Work on the alpha-taxonomy of the Tripterygiidae started in the 1980s; work on the South African Clinidae, the largest group of endemic reef fishes in southern Africa, started in about 2004. Both are ongoing projects.

For the past 12 years I have also been working with a team of editors (Phillip C Heemstra, Elaine Heemstra, David A Ebert and John E Randall) in compiling a multi-volume work on the coastal fishes of the Western Indian Ocean.

OBJECTIVES

The Clinidae and Tripterygiidae are characterised by species complexes and much of the work is focused on attempting to understand these complexes, with a view to eventually contributing to an understanding of the biogeography of the Tripterygiidae in the Indo-Pacific, and the Clinidae in southern Africa. Other, smaller projects are also taken on when these require attention (See below).

PROGRESS

Work with Dr Gavin Gouws and Ms Jessica Glass on a ‘new’ Lethrinus species has made some progress: the species in question had in fact been described in 1908 by Gilchrist & Thompson and named Lethrinus scopaeus. It appears to be one of a small number of species which have overlapping distributions in northern KwaZulu-Natal and southern Mozambique. The species is thus to be resurrected and this is currently in progress. Others that have similar distribution patterns will also be identified.

With the work on the Coastal Fishes of the Western Indian Ocean (CFWIO) book, the Springeratus project with Dr Doug Hoese from Australia and Mr Shen Kang-Ning from Taiwan has made no progress. At the time of writing, the CFWIO text and illustrations are being audited by an independent assessor, and when corrections have been carried out, it will be submitted for layout.

FUTURE WORK

Completion of a review of the Helcogramma obtusirostre species complex (Tripterygiidae) in the Indo-West Pacific, descriptions of new species of Tripterygiidae from the Andaman Islands, and a description of a new species of Clinus from the west coast of South Africa need to be undertaken. The genus Clinus is also due for review as it is possibly not monophyletic. Under consideration is the hypothesis that Indo-Pacific Clinidae should be considered as a family separate from ‘Clinidae’ of the northern hemisphere.

GENERAL

I am also one of the Fishes Editors for the mega journal Zootaxa, and have been since November 2012. In this time, I have processed more than 130 manuscripts for publication.
5. SYSTEMATICS OF SELECTED MARINE FISHES: 3

Project leader: Dr P.C. Heemstra

Project researchers: Dr P.C. Heemstra, Dr F. Uiblein, Dr Y. Sadovy, Dr M. Craig, Dr Y. Iwatsuki

Source of funds: International Union for the Conservation of Nature (IUCN), NRF-SAIAB

Duration of project: 1988 – ongoing

BACKGROUND

In preparation for the CFWIO book, a project that had its origins in the late 1990s, much basic taxonomic research had to be undertaken to fill often huge gaps in our knowledge of the diversity of marine fishes from the region. Over the years this entailed collaborating with numerous specialists around the world on various groups of fishes. The second major project was assembling information for an IUCN publication on the commercial groupers of the world.

OBJECTIVES

The primary objectives were:
(1) Work on the species complexes within the Sparidae for the account of the family by Dr Yukio Iwatsuki.
(2) Review of Pseudanthias for the account of the Serranidae (the groupers) for the family account by Dr Phil Heemstra.

PROGRESS

The Groupers of the World book was published by the National Inquiry Services Centre (NISC) in 2011. Although the Sparidae account for the book on CFWIO has been completed, work on the family has continued.

A taxonomic review of the Indo-West Pacific sparid genus Argyrops with descriptions of three new species by Dr Iwatsuki and Dr Heemstra is in press. All the chapters for the CFWIO book are complete and have been edited ready for layout. Routine identification of CFWIO specimens and photographs were provided for the general public and various scientific colleagues.

FUTURE WORK

Proofreading the CFWIO book, and any final corrections, when the layout has been completed.

SELECTED PUBLICATIONS/REPORTS


Iwatsuki, Y. & Heemstra, P.C. 2015. Redescriptions of Polysteganus coeruleopunctatus (Klunzinger 1870) and P. lineopunctatus (Boulenger 1903), with two new species from the Western Indian Ocean. Zootaxa 4059(1), 133–150.

6. SYSTEMATICS OF SELECTED MARINE FISHES: 4

Project leader: Mr O. Gon

Project researchers: Mr A.L. Stewart, Ms M. Peyper, Dr D. Ebert, Dr P. Psomadakis, Dr A. Prokofiev, Dr M. Okamoto, Dr T. Miya, Dr R. Leslie, Dr P. McMillan, Dr G. Gouws

Source of funds: NRF-SAIAB, NRF

Duration of project: 2012 – ongoing

BACKGROUND

In 2012 Mr Gon was asked to write chapters on the families Bathylagidae and Microstomatidae for a book on the fishes of New Zealand’s Exclusive Economic Zone (EEZ). This required two research visits to the National Museum of New Zealand (NMNZ), Te Papa Tongareva, Wellington. Specimens collected by the fisheries researchers of the Department of Agriculture, Forestry and Fisheries (DAFF) and during a cruise of the Norwegian research vessel, the RV Fridjof Nansen in the Indian Ocean were donated to NRF-SAIAB and include many specimens of taxonomic and biogeographic interest.

OBJECTIVES

Correct identification of specimens of bathylagid and microstomatid fishes at the collection of NMNZ and writing family accounts on these groups for the book on the New Zealand EEZ fishes. Identify specimens in the DAFF and Nansen collection and report on the findings.

PROGRESS

The contribution of chapters on the Bathylagidae and Epigonidae for the New Zealand book led to research on these families in South Africa and the Western Indian Ocean, respectively. Examination of bathylagid specimens at NRF-SAIAB and Iziko Museum resulted in the finding of new records for South Africa. The taxonomy of the genus *Epigonus* is being reviewed with two new species discovered so far.

FUTURE WORK

Further research on the genus *Microstoma* to evaluate the taxonomic status of north east Pacific specimens. A comparison of the bathylagid species of New Zealand and South Africa has started. Identification of *Nansen* material continues.

SELECTED PUBLICATIONS/REPORTS


7. SYSTEMATICS OF GOATFISHES (MULLIDAE)

**Project leader:** Dr F. Uiblein

**Project researchers:** Dr F. Uiblein, Dr G. Gouws, Dr P.C. Heemstra, Tuan Anh

**Source of funds:** Fish Systematics Project, Institute of Marine Research (IMR, Bergen, Norway), Centre for Developmental Cooperation in Fisheries IMR, NRF-IFRR, NRF-SAIAB

**Duration of project:** 2007 – ongoing

**BACKGROUND**

Goatfishes (Family Mullidae) are important components of tropical and temperate marine coastal and upper slope habitats but are insufficiently studied systematically. This applies in particular to the Indo-Pacific region and to the genera *Mulloidichthys*, *Parupeneus* and *Upeneus*. This project focuses primarily on alpha-taxonomy of the genera *Upeneus*, *Mulloidichthys*, and *Parupeneus* using material from recent field sampling and museum collections. Accompanying phylogeographic, phylogenetic and ecological studies will provide insights into evolutionary processes and patterns.

**OBJECTIVES**

Taxonomic species accounts, identification keys and regional reviews of the genera *Upeneus*, *Mulloidichthys* and *Parupeneus* in the Indo-Pacific, with the long-term goal of worldwide revisions. Taxonomic, phylogeographic and phylogenetic hypotheses will be examined by integrating phenotypic data with molecular data using voucher specimens.

**PROGRESS**

Preserved goatfishes of the genera *Upeneus* and *Mulloidichthys* available at NRF-SAIAB and from over 20 other scientific collections (over 1200 specimens of 50+ species) have been examined and compared using over 50 meristic, morphometric and colour characters and colour photographs of fresh fish. So far 12 new species of *Upeneus* from the Indo-West Pacific and one new species of *Mulloidichthys* from the WIO have been described, and a regional review published of each genus for the WIO. In addition, for the genus *Upeneus*, a paper featuring *U. taeniopterus* was published providing a re-description, detailed taxonomic comparisons with all other congeneric species, and distributional as well as barcoding information. Two manuscripts featuring new records of *Parupeneus jansenii* and two new species of *Upeneus* are being prepared.

**FUTURE WORK**

Synonymization of two *Mulloidichthys* species, description of additional new *Upeneus* and *Parupeneus* species from the West Pacific, reporting new records of goatfishes from the Indo-Pacific, and phylogeographic studies of selected goatfish species, using genetic and phenotypic data. Review of the goatfishes from Myanmar for a FAO guide and from Vietnam for the PhD thesis of Mr Tuan Anh Hoang Hoang (Vietnam National Museum of Nature). Further work will also include the genera *Mullus*, *Pseudupeneus*, and *Upeneichthys*. An important component of this work will be to assist in closely monitoring ongoing climate-change-induced range expansion processes towards high latitudes in both hemispheres.

**SELECTED PUBLICATIONS/REPORTS**


8. SYSTEMATIC AND TAXONOMIC STUDIES OF CENTRAL AFRICAN FISHES

Project leaders: Prof. P.H. Skelton and Mr D. Tweddle

Project researchers: Prof. P.H. Skelton and international collaborators, Mr I.R. Bills, Dr J. Day, Dr B. Kramer, Prof. O. Seehausen, Mr W. Conradie, Dr J.R. Stauffer, Dr B. van der Waal

Source of funds: NRF-SAIAB, University of London, MRAC

Duration of project: 2000 – ongoing

BACKGROUND

Tropical central-southern Africa has a diverse Zambezian-dominated fauna. Large areas are, however, poorly explored at the finer-scale and intensive surveys are producing increasing numbers of new species. Expeditionary research on fish distributions, taxonomy and systematics of the region’s freshwater fishes have been continuing since the 1980s. Numerous opportunities have arisen during the last decade through Environmental Impact Assessments and varied conservation programmes, most notably since the 2016 Wild Bird Trust / National Geographic expeditions to the Kavango, Kwando and upper Zambezi systems in Angola.

OBJECTIVES

The main short-term objective is to describe the diversity of the central-southern African region. A longer-term goal is to understand the biogeography of the southern African fauna and how it links with the northern Congo and southern systems.

PROGRESS

Prof. Julia Day led research projects looking at Synodontis and claroteid catfishes and mastacembelid eels. Mormyrid studies, headed by Dr Bernd Kramer, have led to several revisionary papers and new species. Prof. Paul Skelton is working on a revision of the ‘Enteromius mattozi’ group of fishes and on the ‘Enteromius eutaenia’ group from the upper Zambezi region.

Prof. Paul Skelton is now chief scientist for the National Geographic Okavango Wilderness Project managed by the Wild Bird Trust. This project has been sending expeditions to the Okavango in Angola in 2015 and 2016, ongoing into 2017. The 2016 expeditions involved NRF-SAIAB participation by Dr Ben van der Waal, Roger Bills and Nkosinathi Mazungula. Several new species to the southern African region were identified. Taxonomic investigation of this collection continues. An expedition in April 2017 focused on the Cubango tributary of the Okavango. During 2017 a book on the Freshwater Fishes of the Okavango Delta and the Chobe System by M.N. Bruton, G. Merron and P.H. Skelton was completed and is expected to be published in May 2018.

FUTURE WORK

Preparation of species descriptions from various central African collections will be targeted over the next few years. Field work continues in the Okavango and Zambezi system, in Angola, Namibia and Botswana.

SELECTED PUBLICATIONS/REPORTS


9. GENETIC STOCK ASSESSMENTS OF COMMERCIALY IMPORTANT INSHORE FISH SPECIES

Project leader: Dr G. Gouws

Project researchers: Prof. P.D. Cowley, Dr B. Mann, Dr N. James, Dr W. Potts, Dr S. Kerwath, Dr N. Vine, Dr S. Fennessy, Dr R. Bennett

Source of funds: DAFF/NRF Research and Technology Fund (RTF), RU JRC, NRF-SAIAB, NRF-IFRR

Duration of project: 2008 – ongoing

BACKGROUND

Genetic assessments of stock structure are finding increasing use in the identification and management of stocks of important fisheries species, complementing traditional biological, ecological and demographic approaches. This programme provides a genetic assessment of stock structure and variability for a number of economically important inshore and reef fish species supporting important recreational, small-commercial and subsistence fisheries in the Southwestern Indian Ocean. A particular focus is on South African linefishes. Most of these species are slow-growing, long-lived sparids, endemic to South African inshore waters. Many have demonstrated recent stock declines, despite species-specific management interventions. Species considered so far in this programme include black musselcracker/poenskop (Cymatoceps nasutus), blue emperor (Lethrinus nebulosus), white steenbras (Lithognathus lithognathus), red steenbras (Petrus rupestris), bronze bream (Pachymetopon grande), santer/soldier (Cheimerius nufar) and blue bream (Pachymetopon aeneum).

OBJECTIVES

(1) To provide an assessment of genetic structure and variability for exploited, inshore linefish species along the South African coast and/or across the south western Indian Ocean.
(2) To examine the interaction among the movement ecology of these species and population genetic structure.
(3) To examine whether Marine Protected Areas (MPAs) are effective repositories of genetic diversity and effective management interventions, providing input into exploited areas.
(4) To evaluate the extent to which genetic stock assessments can inform management practices.
(5) To provide training to postgraduate students and interns in modern molecular techniques, phylogeography and population dynamics as these relate to fisheries management.

PROGRESS

Studies of poenskop (Cymatoceps nasutus), blue emperor (Lethrinus nebulosus) and white steenbras (Lithognathus lithognathus) have been concluded under this programme. During the past year, the manuscript dealing with white steenbras was published, two manuscripts dealing with Lethrinus and, specifically the blue emperor, were submitted, and the study on blue bream (Pachymetopon aeneum) commenced as an MSc project. Data generation for red steenbras (Petrus rupestris) was concluded and data analysis is currently underway. Laboratory and data analyses for bronze bream, santer and blue bream are continuing.

FUTURE WORK

The study of red steenbras should be concluded and a manuscript submitted in early 2018. Sibusiso Yokwana (MSc candidate, University of Fort Hare) will continue and conclude the genetic study of blue bream in 2018. Renewed RTF funding will be sought for continuation of this research and the inclusion of additional species. Novel genetic approaches and data sets will be explored, given the technical advances of the Aquatic Genomics Research Platform.

SELECTED PUBLICATIONS/REPORTS


10. DIVERSITY OF THE SOUTHERN AFRICAN TEMPERATE FRESHWATER ICHTHYOFANA

Project leader: Dr A. Chakona

Project researchers: Dr E.R. Swartz, Prof. P.H. Skelton, Prof. O. Weyl, Dr G. Gouws, Mr I.R. Bills, Dr R.M. McDowall, Dr S. Crow, Dr B. Sidlauskas, Dr J.A. Cambray, Mr N.D. Impson, Dr M. Jordaan, Prof. P. Bloomer, Dr M. Cunningham, Dr K. Magellan, Mr W. Bronaugh, Mr M. Ramoejane, Ms G. Chakona, Dr W. Kadye


Duration of project: 1992 – ongoing

BACKGROUND

Research on the Cape Fold Ecoregion (CFE) fishes and wider temperate ichthyofauna was motivated in part by the high level of endemicity and by the intriguing relationships of these species to species in neighbouring areas. Extrinsic climatic (sea level changes) and geological (e.g. river capture) processes and intrinsic ecological adaptations seem to have played critical roles in the diversification of CFE fish species.

OBJECTIVES

To study endemic freshwater fish biodiversity in the southern African temperate zone, with emphasis on unique, historically isolated fish lineages and to identify important rivers for the conservation of these lineages. At a systematic and biogeographic level, the relationships between taxa will be interpreted within the framework of the previously suggested biogeographic history of southern African freshwater fauna. At an intraspecific level, genetic diversity could provide information to assist with the formulation of conservation plans for threatened fish species.

PROGRESS

Mr Mpho Ramoejane completed his PhD which focused on the phylogeography of southern African Labeos. Mr Whitcomb Bronaugh completed his PhD on the phylogenetics, biogeography and taxonomic revision of Sandelia capensis. Prof. Skelton and Drs E. Swartz and E. Vreven’s manuscript dealing with the identity of Andrew Smith’s Natural History Museum (London) types of the species currently known as Barbus andrewi and Labeobarbus capensis and the generic placements of all tetraploid cyprinids from the CFE that were previously placed in the genus Barbus was accepted for publication in the European Journal of Taxonomy. Dr Chakona and Prof. Skelton published a comprehensive revision of the taxonomy of the Eastern Cape redfin, Pseudobarbus afer, in ZooKeys. Topotypes of all freshwater fishes that were described from the CFE were collected and barcoded. The IUCN red-listing assessment of the conservation status of South African freshwater fishes was concluded, and a number of the assessments have already been published by the IUCN, including the status of several recently identified genetic lineages from the CFE.

FUTURE WORK

A manuscript on the taxonomic revision of the Cape galaxias, Galaxias zebratus, is currently being prepared. Taxonomic revisions of Pseudobarbus burchelli, Amatolacypris trevelyani and Sandelia bainsii are ongoing. Extensive surveys are continuing to collect foundational biodiversity data on stream fishes of the CFE as part of BioGaps (an NRF-FBIP funded multi-institutional collaborative programme) to inform Strategic Environmental Assessments for Shale Gas Development and other infrastructure development projects in the Karoo Basin.

SELECTED PUBLICATIONS/REPORTS


11. DIVERSITY AND ECOLOGY OF TROPICAL AND SUB-TROPICAL AFRICAN FRESHWATER FISHES

Project leader: Dr A. Chakona

Project researchers: Dr A. Chakona, Dr E.R. Swartz, Prof. P.H. Skelton, Mr I.R. Bills, Mr D. Tweddle, Dr L. da Costa, Dr J. Day, Dr B. Kramer, Mr O. Gon, Mr P. Maake, Dr W. Cotterill, Mr F. Roux, Dr W. Kadye, Dr C. Phiri, Dr T. Bere, Dr E. Vreven, Ms B. Motshegoa, Mr T. Smith, Mr N. Mazungula, Ms A. Zonda

Source of funds: NRF, NRF-SAIAB

Duration of project: 2008 – ongoing

BACKGROUND
The tropical and sub-tropical regions of southern Africa have higher diversity and lower endemicity than the temperate zone. Several families and genera can therefore be investigated to infer drainage history, mainly associated with the Congo and Zambezian ichthyofaunas. Although research on tropical and sub-tropical southern African fishes has been ongoing for many years, NRF-SAIAB’s Memorandum of Understanding (MOU), signed with the Africa Earth Observation Network at the University of Cape Town, and major collaborations with scientists from the United Kingdom (UK) and Germany has formalised this research into a concerted effort to compare phylogenetic relationships of fishes with known earth history.

OBJECTIVES
The main objective is to undertake comparative phylogeography across as many groups of taxa as possible, and to compare results with known earth history. Several questions will be addressed, mainly focused around the hypothesis that fishes are good indicators of drainage history. The initial research programmes will focus on the Congo-Zambezi axis, diversification in the Okavango, potential early isolation of the Kunene and recent connections among eastern flowing river systems.

PROGRESS
Researchers from NRF-SAIAB and Ezemvelo KZN Wildlife published the rediscovery of the Maloti minnow from the Mzimkulu River system, almost eighty years after this species was declared extinct in South Africa. Progress has been made in understanding global cyprinid relationships through the Cyprinid Tree of Life (CToL) initiative. Prof. Julia Day is leading research that involves Roger Bills and Ernst Swartz on Synodontis catfishes to better understand diversification in the Okavango. Pholoshi Maake completed his PhD on the genetic and morphological diversity of Marcusenius in 2014. Luis da Costa completed his PhD on the chubbyhead barb group in 2013. Dr Chakona is collaborating with Drs Emmanuel Vreven from the Royal Museum for Central Africa in Belgium, and Dr Ulrich Schliwenn from the Zoologische Staatsammlung München in Germany on the systemsatics and taxonomic revision of Labeobarbus natalensis and research on the diversity of Labeobarbus species in the Kwanza. Bosupeng Motshegoa is doing her PhD on the systematics and biogeography of mountain catfishes (Amphilius) in southern Africa. Timothy Smith has completed his MSc on the diversity of Nannocharax in southern Africa. Nkosinathi Mazungula is doing his MSc on the taxonomic revision of Amphilius natalensis. Tadiwa Mutizwa is doing his MSc on the biogeography and systematics of the slender stone basher, Hippopotamyrus ansorgii, in southern Africa. Surveys have also been conducted to collect topotypic material of freshwater fishes from KwaZulu-Natal, Mpumalanga, Limpopo and Gauteng Provinces.

FUTURE WORK
Funding has been secured to initiate a study on the systematics and biogeography of mountain catfishes (Amphilius spp.) in southern Africa and to undertake nationwide surveys to collect and barcode topotypes of all freshwater fish and frog species from South Africa. Evaluation of the taxonomic integrity of newly identified lineages of fishes from the Eastern Highlands of Zimbabwe is being done through collaboration with Dr Emmanuel Vreven. Prof. Taurai Bere of Chinhoyi University of Technology in Zimbabwe and Dr Wilbert Kadye from Rhodes University. Prof. Paul Skelton and Dr A. Chakona are collaborating on a project to revise the taxonomy of the orange fin barb (Enteromius eutaenia). Dr Melissa Martin from the University of Malaysia will visit NRF-SAIAB from October to December 2018 to collaborate with Dr Chakona on the revision of the soft-rayed spotted barbs in southern Africa.

SELECTED PUBLICATIONS/REPORTS
12. WESTERN INDIAN OCEAN MARINE FISH BIOGEOGRAPHY

Project leader: Dr G. Gouws

Project researchers: Dr S. Fennessy, Dr M. Mwale, Dr J. Mwaluma, Dr A. MacDonald, Ms L. Cele, Ms S. Ockhuis, Ms Fiona Mackay, Mr Steven Weerts

Source of funds: DST-NRF ACEP Phase 3 (‘Suitcase Project’)

Duration of project: 2008 – 2016

BACKGROUND

Ongoing exploration and sampling have advanced our knowledge of the fish diversity of the Western Indian Ocean (WIO), but there remains no clear understanding of the origins of this fauna. Two competing hypotheses have been proposed to account for the diversity and presence of the regional and marginal faunas in the WIO: (1) dispersal from a centre of origin in the central Indo-West Pacific or (2) in situ origins resulting from vicariance brought about by geological or oceanographic features and processes. In this programme, studies of broad-scale phylogeography and finer-scale population genetic structure of various widespread, predominantly reef-associated and inshore species are conducted to understand their biogeography, and the influence of oceanographic features and life-history parameters on patterns of distribution and diversity.

OBJECTIVES

(1) To determine the geographic genetic structure of multiple taxa in the WIO.
(2) To identify the processes or events which have determined and maintain this structure.
(3) To identify unique phylogeographic/biogeographic provinces and potential phylogeographic breaks in the WIO.
(4) To examine the taxonomic status of widespread species within the region, and to identify and describe new species, if necessary.
(5) To consider the effects of ecological constraints, oceanography and species biology on gene flow and genetic structure.
(6) To consider the integration of genetic information in understanding oceanographic processes and in informing conservation planning, and fisheries resource and biodiversity management.

PROGRESS

Earlier phases of the programme, funded by Western Indian Oceans Marine Science Association – Marine Science for Management (WIOMSA-MASMA) and ACEP Phase 2, have been concluded. More recently, this broad theme was addressed through the ACEP Phase 3 “Suitcase Project”, which examined connectivity of marine fishes between KwaZulu-Natal and south east Madagascar. Two students on this project, Lindile Cele (MSc, UKZN) and Samantha Ockhuis (MTech, CPUT) graduated in early 2017. Samantha’s meroplankton work was also published during 2017. Publications resulting from the earlier research are currently being prepared for submission. Although officially concluded, aspects of the “Suitcase Project” are continuing, with new projects launched to examine patterns of connectivity in estuarine fishes (and several invertebrates) with varying degrees of estuarine dependency, in collaboration with Fiona Mackay (SAAMBR-ORI) and Steven Weerts (CSIR). This will provide an additional perspective on marine and estuarine biogeography in the WIO. Future work under this programme will be conducted under the CAPTOR project, funded during 2017 by the latest ACEP Open Call. Under this programme, marine fish connectivity will be studied (using genomic approaches) along the east coast of South Africa to understand connectivity, spill over and provisioning with respect to existing and proposed MPAs.

FUTURE WORK

Manuscripts resulting from Lindile Cele’s MSc will be prepared in early 2018. Samantha Ockhuis will undertake the fish genetics work on the CAPTOR programme for a PhD (Rhodes University), commencing in 2018. Manuscripts from the earlier components of this project require attention and will be addressed systematically throughout 2018 and beyond.

SELECTED PUBLICATIONS/REPORTS


13. BARCODING OF AFRICAN AQUATIC ORGANISMS

**Project leader:** Dr G. Gouws

**Project researchers:** Dr M. Mwale, Dr A. Chakona, Prof. P.H. Skelton, Dr R. Hanner, Prof. P. Hebert, Dr P. Heemstra, Ms E. Heemstra, Mr O. Gon, Mr R. Bills, Mr D. Tweddle, Dr T. Hoareau, Dr B. Mann, Dr S.T. Fennessy, Dr D. Parker, Dr K. Sink, Dr W. Florence, Prof. C.L. Griffiths, Mr. J. Landschoff, Dr A.H.H. MacDonald, Mr W. Conradie, other African Regional Working Group members and collaborators from the University of Guelph in Canada

**Source of funds:** FISH-BOL, CBOL, IBOL, NRF-SAIAB, Norwegian Directorate for Nature Management, Canadian Centre for DNA Barcoding (University of Guelph) and Genome Canada, NRF-FBIP

**Duration of project:** 2006 – 2018

**BACKGROUND**

DNA barcoding is a global effort to coordinate the assembly of a genetic reference library for all species, derived from voucher specimens with authoritative taxonomic identifications. Barcoding is based on sequencing a standardised portion of the mitochondrial cytochrome c oxidase subunit I (COI) gene. The aim of barcoding is to facilitate species identification for all potential users (including taxonomists), highlighting specimens that represent a range expansion of known species, flagging previously unrecognised species, and enabling identifications where traditional methods are not applicable. The barcoding effort at NRF-SAIAB is mainly focused on fishes, through the Fish Barcode of Life Initiative (FISH-BOL); additional barcoding projects are also in process on amphibians (together with Port Elizabeth Museum), freshwater invertebrates (together with Albany Museum) and marine invertebrates (with SANBI, University of Cape Town (UCT) and UKZN).

**OBJECTIVES**

The objectives of FISH-BOL are to barcode all Africa’s marine, estuarine and freshwater fishes to assist taxonomists in identifying fish species and to understand lineage diversity. The objectives of the amphibian and invertebrate barcoding projects are to focus on particular groups of taxonomic interest and expand the barcoding database for lesser known South African groups.

**PROGRESS**

DNA barcoding of marine and freshwater fishes continued in an ad hoc way during 2017, with NRF-SAIAB making continued contributions to the broader barcoding initiative and in fulfilling the Institute’s commitments. To date, NRF-SAIAB’s contributions to the Barcode of Life Database (BOLD) include over 3200 records of marine fish from the Western Indian Ocean, with barcodes for around 970 species, more than 290 records of Southern Ocean/Sub-antarctic and South Indian Ocean fishes (with around 50 species barcoded), and records of more than 1500 freshwater fish and 150 amphibians, mainly from southern Africa, but also from across the continent. An earlier collaboration between NRF-SAIAB, SANBI and the Museum of Natural History and Archaeology in Trondheim, Norway, also produced DNA barcodes for 800 additional specimens of amphibians, fish, insects and crustaceans.

NRF-SAIAB’s major barcoding commitment over 2017 was its contribution to the SeaKeys: Unlocking foundational marine biodiversity knowledge project, funded by NRF-FBIP and managed by SANBI. At the project’s conclusion at the end of 2017, more than 760 specimens (of the 1446 specimen records registered) had been barcoded, representing around 230 species of marine invertebrates.

**FUTURE WORK**

NRF-SAIAB will continue to support the International Barcode of Life (IBOL) initiative in South Africa through its ongoing marine and freshwater work in the region. A new collaborative barcoding project was launched in 2017, funded by the NRF-FBIP and involving collaboration among the University of Pretoria, NRF-SAIAB, SAAMBR-ORI and DAFF. This project aims to establish a reference barcode library for all South Africa’s exploited linefishes.

**SELECTED PUBLICATIONS/REPORTS**


14. FRESHWATER CRAB DIVERSITY, SYSTEMATICS, DISPERSAL AND BIOGEOGRAPHY

Project leader: Dr G. Gouws

Project researchers: Prof. N.P. Barker, Dr F. Porri, Prof. R. Perissinotto, Dr N. Peer, Dr N. Miranda, Prof. S.R. Daniels, Mr B. McClure, Ms F. de Beer

Source of funds: NRF-CPRR, NRF-SAIAB

Duration of project: 2014 – 2017

BACKGROUND

The freshwater crabs of South Africa (all belonging to a single genus, *Potamonautes*) were the focus of an intensive systematic study concluded a decade ago. Seven new species were described, bringing the total known from the country at the time to 13; most of these are endemic. However, this research focused mainly on the Western Cape and areas of KwaZulu-Natal, and many regions – such as the Eastern Cape – were overlooked and unexplored. Research conducted since has increased the number of species to 19, and has highlighted several possibly new species from these unsampled areas. Additionally, earlier research relied on markers that were insensitive to fine-scale population structure and possibly overemphasised dispersal among catchments and over vast geographic regions. The present research will use sequence data to identify and delineate new lineages and species and will develop and use highly-variable microsatellite markers to examine finer patterns of gene flow and connectivity over smaller spatial scales. Knowledge of such patterns can aid the understanding of speciation in, and biogeography of the group. Understanding dispersal also has human health implications, with freshwater crabs being an intermediate host for lung-flukes, which cause paragonimiasis.

OBJECTIVES

(1) To develop a microsatellite library for fine-scale, population genetic studies of freshwater crabs.
(2) To investigate the phylogeography of *Potamonautes sidneyi*, one of the most widespread species in the country.
(3) To investigate the diversity and possible presence of novel cryptic species along the eastern Great Escarpment.
(4) To provide taxonomic descriptions for new species encounters.
(5) To understand dispersal within and among river systems, using the Kei River system as a model.
(6) To investigate the impact of Inter-Basin Water Transfer schemes (IBTs) on the dispersal of freshwater crabs.
(7) To determine the occurrence of the lung fluke, *Paragonimus*, and other parasites in freshwater crabs, and to consider the potential spread of paragonimiasis and other diseases with the dispersal of crabs.

PROGRESS

Field work for the study of dispersal in the Kei system (Objective 5 above) was concluded. The microsatellite library for freshwater crabs was constructed and is presently being applied in case studies. On the taxonomy front, a new species (*P. danielsi*) was described from KwaZulu-Natal and a more complete (re)description of the widely distributed *P. sidneyi* was provided. The phylogeographic study of the latter continued, with a collaboration with Prof. Savel Daniels (University of Stellenbosch) providing more material. Several potentially new species have been identified among these. Two MSc students on the project, Bruce McClure (Rhodes University) and Frankie de Beer (Rhodes University), continued their studies in 2017.

FUTURE WORK

The manuscript detailing the microsatellite markers is currently being prepared for submission. This marker set will then be used to complement the existing study of the Kei system and of dispersal with respect to IBTs. The broad-scale phylogeographic study of *P. sidneyi* (incorporating *P. danielsi*) will be concluded in 2018 and the manuscript prepared. Similarly, taxonomic descriptions of any new species, including three from the Eastern Cape, will follow.

SELECTED PUBLICATIONS/REPORTS


CONSERVATION BIOLOGY & ECOLOGY

Conservation Biology & Ecology research at NRF-SAIAB focuses on understanding the processes underpinning aquatic biodiversity in order to inform the conservation of those resources.
15. AFRICAN COELACANTH ECOSYSTEM PROGRAMME (ACEP)

**Project leader:** Dr A.W. Paterson  
**Project researchers:** This programme currently provides a platform for six competitively funded Open Call research projects and a Human Capacity Development (HCD) programme facilitated by NRF-SAIAB through ACEP  
**Source of funds:** DST, DEA and DAFF  
**Duration of project:** 2007 – ongoing

**BACKGROUND**

ACEP entered its fourth phase in 2015, a phase which has run for three years. As with the second and third phases, there was an Open Call for research proposals which received much interest from the marine science community in South Africa. After a peer-review process and a panel decision, six (6) multi-disciplinary, multi-institutional projects were awarded funding and access to ACEP platforms. These projects involve over 70 researchers from 12 research institutes and 11 universities.

One third (33%) of ACEP funds is ring-fenced for establishing Marine Science at historically black universities (HBUs). Currently the programme reaches Walter Sisulu University (WSU) and the University of Fort Hare (UFH) in the Eastern Cape, the University of Zululand (UniZulu) in KwaZulu-Natal and the University of the Western Cape (UWC). This strategic initiative, the Phuhlisa Programme, managed by a dedicated HCD Coordinator, offers support to marine scientists at these universities through platform provision, logistical support for fieldwork, student bursaries and co-supervision. The programme also offers additional academic and life skills courses, for example, academic writing, presentation skills, swimming lessons, and skipper’s licence.

**OBJECTIVES**

Through an open, transparent and competitive funding call made every three years, ACEP aims to provide the South African marine research community with the means, vessels and equipment to conduct high-quality, multi-disciplinary research, to foster collaboration and to provide student bursaries to facilitate training and capacity building.

**PROGRESS**

Publications: The ACEP publication list continues to grow, with a total of 175 peer-reviewed papers to date.  
**Marine Platform Provision:** The R/V uKwabelana and R/V Phakisa are used on a monthly basis by a wide range of projects from the ACEP Open Call, operating out of Algoa Bay, East London, Durban and Richards Bay. They also service the ACEP Phuhlisa programme and partner institutions. The marine platforms have grown, and several fully functional units are now on offer. These include the coastal craft platform, remote imagery platform, geophysics and benthic mapping platform, and the acoustic telemetry array platform.

Technical support provided to the six ACEP-funded Open Call projects:

1. Deep Secrets (Dr K. Sink): Ship-based cruise on the R/V Algoa forms part of ACEP Phakisa Ocean Cruises on the Agulhas Shelf Edge, primarily conducting visual benthic surveys. This cruise was completed in October 2016. A major component of this is feeding data into Operation Phakisa’s Marine Spatial Planning (MSP) for Marine Protected Areas (MPAs).
2. Transkei Shelf Edge (Dr R. Barlow): Ship-based cruises on the R/V Algoa off the Transkei Shelf took place in January and June 2017. This forms part of ACEP Phakisa Ocean Cruises and focuses largely on physical oceanography of the region.
3. Larval dispersal in Algoa Bay (Dr F. Porri): Extensive use of R/V uKwabelana, ACEP Platform equipment and technical assistance in and around Algoa Bay.
4. Benthic Biodiversity from the Agulhas Bioregion as a source of new pharmaceuticals (Prof. R. Dorrington): Extensive use of R/V uKwabelana and ROV in Algoa Bay, as well as use of SAEON platforms. Benthic surveys and collections for pharmaceutical research are underway.
5. Interdisciplinary spatial solutions for marine conservation planning (Prof. A. Green): This project is making use of the ROV, multi-beam sonar and other oceanographic equipment off a three-party vessel (R/V Angra Pequena). The project is well underway with the first six-week survey completed in 2016 and the second planned for 2017. This project will feed valuable baseline data into MSP associated with three proposed MPAs in KwaZulu-Natal. The project has leveraged funding to set up a large capacity-building programme called Ocean Stewards. In 2015 and 2016 a total of 35 students were provided the opportunity to participate in the research cruises and interact closely with researchers. A further 16 students will participate in the programme in 2017.
6. Imida: Frontiers Project (Dr S. Kerwath): This project made extensive use of R/V Phakisa and the ROV in the East London area as well as the multi-beam sonar off leveraged platforms from DAFF.

**FUTURE WORK**

The three-year ACEP funding cycle (2015–2018) projects have completed their fieldwork components. The next Open Call was advertised in 2017 and projects selected for 2018–2020. A positive response to the call saw four projects being selected for support. The proven concept of shared coastal craft has led ACEP to begin expanding the Marine Platform. While R/V uKwabelana services the Algoa Bay region and R/V Phakisa is based in KwaZulu-Natal from 2017, a third vessel build is planned for 2019. ACEP plans to expand its Marine Platform to the southern or Western Cape as well as add capacity to its existing platforms.
16. LARVAL ECOLOGY

**Project leader:** Dr F. Porri

**Co-investigators:** Dr P. Pattrick, Prof. C.D. McQuaid, Prof. P. Teske

**Project researchers:** Dr N. Weidberg, Dr P. Pattrick, Dr M. Tagliarolo, Ms K-A. Van der Walt, Mr O. Duna, Mr L. Vorsatz, Ms Z. Somana, Mr S. Mafanya, Ms J. Trassierra, Ms J. Oliver; Mr S. Dyantyi, Ms S. Reddy, Ms N. Matam, Mr S. Mqotho

**Project collaborators:** Dr J. Jackson (Hakai Institute, Canada), Dr W. Goschen (NRF-SAEON)

**Source of funds:** NRF (ACEP)

**Duration of project:** 2012 – ongoing

**BACKGROUND**

Research on larval ecology at SAIAB mostly investigates the spatio-temporal scales of larval transport and processes that influence successful settlement in an array of natural and man-made coastal systems. Additional focus by the Coastal and Ocean Sciences Team (COST) aims at incorporating studies on the organismal biology of fish and invertebrate larvae to further understand the underlying behavioural, physiological and molecular mechanisms of larval transport and settlement into the adult habitats. Through the recently established aquatic ecophysiology research platform at NRF-SAIAB, we address research that focuses on the physiological/organismal factors that influence larval survival, growth and overall fitness. Larval ecology is, however, currently limited by the poor understanding of larval taxonomy as most marine larvae cannot be identified accurately based on their morphology. COST is therefore also addressing these taxonomic gaps through an across-taxon target of DNA barcoding of larvae.

**OBJECTIVES**

The projects address the lack of knowledge of the micro- and meso-scale physical processes that influence the inshore distribution of marine larvae with important repercussions on the overall population connectivity.

**PROGRESS**

During 2017, research on larval ecology by the COST has focused mainly on two systems: coastal environments adjacent to rocky shores (natural and man-made) and mangroves. Larval distribution and settlement/recruitment of invertebrates has been investigated in relation to prevailing winds, under the broader project funded by the African Coelacanth Ecosystem Programme (ACEP) on the pathways of larval dispersal. This study has not been completed yet as further adaptive, hypotheses-driven questions will be addressed during 2018. The role of mangrove microhabitats as nurseries for fish and invertebrate larvae is also one of the main projects initiated during 2017. Most samples have been collected and analysis is currently underway. Physiological experiments on larval metabolism have been initiated, while bacterial metabolism from mangrove substrate has also been investigated. Finally, such population and organism-based research has been complemented by DNA barcoding analyses of fish larvae from nearshore waters.

**FUTURE WORK**

Some of these projects will be finalised during 2018, while final manuscripts from this project will be produced. Meanwhile an additional project, through the Community of Practice, has been awarded to the team for further research on the wind effects of larval transport.
17. EFFECTS OF CLIMATE CHANGE ON THE PHYSIOLOGY OF COASTAL FISH AND INVERTEBRATES

**Project leaders:** Dr N. James and Dr W. Potts

**Project researchers:** Dr F. Porri, Dr A. Childs, Ms C. Edworthy, Mr B. Erasmus, Ms S. Wilsnagh, Ms K-A. van der Walt, Mr M. Duncan, Mr J. Kemp, Prof. A. Bates, Mr P. Mpopetsi

**Collaborators:** Dr S. Kerwath, Dr H. Kaiser

**Source of funds:** NRF, DAFF and Rhodes University

**Duration of project:** 2015 – 2017

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**BACKGROUND**

Coastal ecosystems are highly impacted by human activities such as habitat destruction and overfishing, with impacts associated with climate change placing additional pressure on these ecosystems. A change in climate incorporates changes in temperature, wind patterns, evaporation rates, precipitation and CO$_2$ concentrations. These environmental changes are likely to have major implications for coastal fish species. An understanding of physiological changes is needed to reliably project the effects of climate change on animals, particularly in unstable, temperate environments. NRF-SAIAB's Aquatic Ecophysiology Research Platform (AERP) provides a unique opportunity to initiate this type of research in South Africa.

**OBJECTIVES**

To understand the physiological impact of changing temperatures and pH on various temperate and sub-tropical fish and invertebrate species.

To predict the potential impacts of warming and cooling on different species of fishes and key invertebrates.

To determine whether elevated CO$_2$ and reduced pH, consistent with ocean acidification predictions, could affect the physiology of dusky kob (*Argyrosomus japonicus*) larvae/juveniles and affect their ability to respond to olfactory cues when searching for estuarine nursery habitats.

**PROGRESS**

Three MSc students (Ms C. Edworthy, Mr B. Erasmus and Mr P. Mpopetsi) studied the effects of elevated CO$_2$ and reduced pH on the physiology of dusky kob (*Argyrosomus japonicus*) larvae/juveniles. Ms Edworthy and Mr Erasmus completed their MSc degrees in 2017. Mr Mpopetsi finished his experiments in 2017. An Honours student (Ms S. Wilsnagh) assessed what attracts larval dusky kob into estuaries – olfaction or turbidity. The results from her study suggest that larval dusky kob are attracted to turbid water when recruiting into estuaries. PhD student, Ms K-A. van der Walt, is studying the impacts of warming and cooling on various coastal and estuarine species and Mr M. Duncan, also a PhD student, is studying the effects of warming and overfishing on the linefish species *Chrysoblephus laticeps*. Mr Duncan finished his experimental work in 2016 and spent 2017 at the University of Southampton writing up his PhD. Ms van der Walt will finish her experiments and write up in 2018. Ms Edworthy registered for a PhD degree in 2017. She is studying the effects of elevated CO$_2$ and reduced pH on the early life history of two sparid species with different life-history strategies.

**FUTURE WORK**

Two new PhD students are set to start in 2018 under an ACEP-funded project. They will be looking at whether MPAs afford species some level of resilience to the effects of climate change.

**SELECTED PUBLICATIONS/REPORTS**

18. ASSESSING NURSERY HABITATS FOR ESTUARY-ASSOCIATED FISH SPECIES

**Project leader:** Dr N.C. James

**Project researchers:** Dr N.C. James, Dr W.M. Potts, Dr A. Rajkaran, Mr T. Leslie, Dr A. Paterson, Ms P. Nodo, Mr R. Palmer, Dr V. Nakin, Mr E. Bornman, Dr A-R. Childe

**Source of funds:** NRF, NRF-SAIAB, Rhodes, DST

**Duration of project:** 2005 – ongoing

**BACKGROUND**

The habitat types found within estuaries (e.g. saltmarsh, eelgrass, sand, mud, rocks) are of varying degrees of importance to juvenile fish species because different habitat types provide different sets of resources. However, little is known about the relative importance of the habitat types found in South African estuaries and their nursery value for estuary-dependent marine species. Similarly, on an estuary scale, different types of estuaries may be more important as nursery areas for estuary-dependent marine species.

**OBJECTIVES**

1. To determine habitat complexity within the Bushman’s Estuary and the abundance and diet of *Rhabdosargus holubi* in different habitat types and hence the suitability of different estuarine habitats as nursery areas.
2. To determine habitat complexity in the lower reaches of the Mngazana Estuary and to assess whether more structurally complex habitats have more abundant and diverse fish assemblages.
3. To determine the importance of two different estuary types, a turbid estuary (Great Fish) and a clear, freshwater-deprived estuary (Kariega) to benthic fish, particularly juvenile *Pomadasys commersonnii* and *Argyrosomus japonicus*.
4. To determine the importance of coastal and estuarine nursery habitats as nursery areas for estuary-associated fish species.

**PROGRESS**

MSc student, Mr T. Leslie, found that although *Rhabdosargus holubi* were most abundant in seagrass beds in the Bushman’s Estuary, they were feeding in different habitats throughout the estuary. Mr Leslie completed his thesis in 2015. Honours student, Mr E. Bornman, who completed his project at the end of 2015, assessed whether more structurally complex habitats have more abundant and diverse fish assemblages. Honours student Ms R Keur assessed the fish assemblages of two emergent vegetated habitats (mangroves and salt marsh) in the Nahoon Estuary in 2017. MSc student, Ms P. Nodo, found that a major flood in the Kariega Estuary allowed for the re-establishment of an important nursery function in this estuary, particularly for early juvenile dusky kob and spotted grunter. In contrast, flooding in the freshwater-dominated Great Fish Estuary resulted in a temporary decline in both the diversity and abundance of fish in the estuary. Ms P. Nodo submitted her thesis in February 2016 and registered for a PhD degree to examine the importance of coastal and estuarine nursery habitats to estuary-associated species in Algoa Bay. Ms P. Ndaleni registered for a PhD degree in 2017, examining the utilisation of different estuarine habitats by co-occurring species of gobies.

**FUTURE WORK**

Papers from the above studies will be produced in 2018.

**SELECTED PUBLICATIONS/REPORTS**


Nodo, P. 2016. Distribution and abundance of demersal fish species, with emphasis on dusky kob and spotted grunter, in the Kariega and Great Fish estuaries. MSc thesis, Walter Sisulu University, Mthatha.


19. KOWIE SYSTEM FISH CONNECTIVITY STUDIES

**Project leaders:** Prof. A.K. Whitfield and Prof. P.D. Cowley

**Project researchers:** Prof. A.K. Whitfield, Prof. P.D. Cowley, Dr L. Carassou, Ms T. Murray, Mr M. Magoro, Mr G. Grant

**Source of funds:** WRC, NRF, NRF-SAIAB, RU

**Duration of project:** 2012 – 2017

**BACKGROUND**

A series of projects involving MSc and PhD students, as well as a postdoctoral fellow, are being conducted on a variety of fish species in the Kowie Estuary and lower reaches of the river, with an emphasis on ecosystem connectivity. Postgraduate studies involve the possible impact of invasive largemouth bass, *Micropterus salmoides*, in breaking down the connectivity of juvenile marine fishes with the lower reaches of the Kowie River (MSc study), feeding ecology of freshwater mullet *Myxus capensis* (Postdoc study), with movement behaviour studies of the leervis *Lichia amia* (PhD study) and the Cape stumpnose *Rhabdosargus holubi* (MSc study) also being conducted.

**OBJECTIVES**

To assess the degree of trophic connectivity between the river, estuary and marine environment using diet, stable isotope and fatty acid analyses in a range of marine and freshwater fish species in the Kowie system.

To determine the role of an alien fish predator on juvenile fish connectivity between the Kowie Estuary and River.

To study the movements and estuary use of an indigenous marine piscivore, omnivore and an alien freshwater piscivore using acoustic telemetry.

**PROGRESS**

Dr Laure Carassou has completed her postdoctoral dietary, stable isotope and fatty acid studies on *R. holubi* and *M. capensis*. Two papers, one exploring dietary and stable isotope changes of *R. holubi* marine, estuarine and freshwater environments and one on *M. capensis* in the headwater region have been published.

Gareth Grant also published two papers from his MSc on acoustic telemetry investigations into the movements and space use patterns of *R. holubi* in the Kowie Estuary (see below).

Taryn Murray's PhD study on the movements and migrations of the leervis, *Lichia amia*, has been completed and results show that this species predominantly uses the lower reaches of the estuary but also congregates in areas of the estuary that receive small lateral streams, thus emphasising the catchment connectivity theme once again.

**FUTURE WORK**

The Kowie Estuary collaborative research project is now complete.

**SELECTED PUBLICATIONS/REPORTS**


20. BIOLOGY AND ECOLOGY OF FISHES IN ESTUARIES

Project leader: Prof. A.K. Whitfield

Project researchers: Prof. A.K. Whitfield, Dr T.D. Harrison, Prof. M. Elliott, Prof. P.D. Cowley

Source of funds: NRF

Duration of project: 1992 – ongoing

BACKGROUND

This research programme covers a number of projects on fishes in estuaries. Foremost in the priority list has been the production of an updated scientific book on the biology and ecology of fishes in southern African estuaries. This was followed by several review papers which have placed South African estuarine fish ecology in a global perspective. More recently, a book on fish and fisheries in global estuaries has been initiated.

OBJECTIVES

The four major objectives of this research programme are as follows:

1. To produce a book synthesising information on the fishes of southern African estuaries.
3. To produce reviews on fishes in South African and global estuaries.
4. To edit a book on fish and fisheries in estuaries around the world.

PROGRESS

In 2010, an invited review paper on the conservation of fishes in South African estuaries was published and, in 2011, a global review on the biology and ecology of the flathead mullet, *Mugil cephalus*, appeared. In 2012 a major paper was published on fish trophic structure in South African estuaries, with particular emphasis on estuarine typology and zoogeography. This was followed in 2013 by a collaborative paper on the potential effects of artificial light on estuary-associated fish species and in 2014 by a review of the impact of recreational motor boats on fishes in estuaries. In 2015 a review paper on habitat type and nursery function in the Eastern Cape coastal zone was also published. In 2016 there was a series of review chapters published in a book about the biology and ecology of grey mullet around the world, as well as a synthesis paper on the biomass and productivity of fishes in estuaries. In 2017 three new review papers were published in top journals such as Conservation Biology, Reviews in Fish Biology & Fisheries, and Ecology & Evolution.

FUTURE WORK

A number of review papers have been submitted or accepted for publication and will appear in 2018. In addition, a collaborative manuscript with Dr Trevor Harrison on the trophic structure of fishes in global estuaries is nearing completion. Work on the book entitled Estuarine Fish and Fisheries is also at an advanced stage.

SELECTED PUBLICATIONS/REPORTS


Whitfield, A.K. 2017. The role of seagrass meadows, mangrove forests, salt marshes and reed beds as nursery areas and food sources for fishes in estuaries. Reviews in Fish Biology and Fisheries 27, 75–110.


21. BIOTELEMETRY AND MOVEMENT BEHAVIOUR OF IMPORTANT FISHERY SPECIES

Project leaders: Prof P.D. Cowley

Project researchers: Prof. P.D. Cowley, Dr T.F. Næsje, Dr A-R. Childs, Dr R.H. Bennett, Dr T.S. Murray, Dr R. Daly, Dr J. Filmalter, Dr B. Mann

Source of funds: NRF, Research Council of Norway, Save Our Seas Foundation, NRF-SAIAB

Duration of project: 2003 – ongoing

BACKGROUND

The sustainability of coastal fisheries in South Africa is questionable as the stocks of many species are considered to have collapsed. It is therefore important to develop sound management practices based on adequate knowledge of the biology, habitat use and migratory patterns of the targeted species. Tracking individuals tagged with acoustic transmitters provides statistically powerful real time information to investigate aspects of fish behaviour crucial for fisheries management. In recent years, NRF-SAIAB has developed strong international partnerships (e.g. the Ocean Tracking Network headquartered at Dalhousie University, Canada) and developed a significant marine research platform in the form of the Acoustic Tracking Array Platform (ATAP). The deployment and maintenance of acoustic receiver arrays from Hout Bay to Ponto do Ouro provides improved listening power and means to study migration biology. The ATAP serves many other researchers who acoustically tag marine animals and there is continued growth in this research discipline in South Africa.

OBJECTIVES

1. To describe the movement behaviour and habitat utilisation of important fishery and conservation icon species.
2. To establish the periodicity and duration of fish movements between sheltered coastal habitats and the sea.
3. To describe behavioural responses to the abiotic environment (e.g. temperature, salinity and turbidity).
4. To elucidate seasonal movement patterns and timing of annual migrations.
5. To collate fishery data with observed movement trends and assess the species vulnerability to local depletion.

PROGRESS

The formalisation of the national ATAP platform provides an unprecedented opportunity to study coastal fish movements. Tagging efforts have focused on the adults of several important estuary-associated fishery species at different localities around the coastline, coastal fishery species (e.g. giant kingfish) and elasmobranchs, particularly stingrays.

FUTURE WORK

Research efforts will continue to focus on estuarine associated species such as leervis, river bream, giant kingfish and juvenile Zambezi sharks. Emphasis will be placed on multiple habitat use (i.e. more than one estuary), homing to natal nursery areas and coastal migration in adults. Dedicated study sites include the Breede Estuary (Western Cape) and Kowie Estuary (Eastern Cape). Increased efforts will be placed on tagging a number of data-deficient stingray species.

SELECTED PUBLICATIONS/REPORTS


22. STRUCTURE AND CONDITION OF SOUTH AFRICA’S HIGH LATITUDE CORAL REEFS

Programme leader: Dr A. Bernard

Source of funds: iSimangaliso Wetland Park, NRF-SAIAB, Global Finprint programme

Duration of project: 2016 – Present

BACKGROUND

Subtidal reef habitats along the south and east coastlines of South Africa harbour high levels of marine biodiversity, with many species being endemic to the region. However, these habitats are under increasing pressure to provide services and resources to support recreational and industrial activities, food requirements and employment opportunities for the ever-expanding human populations. Around South Africa, marine protected areas (MPAs) have been promulgated to protect biodiversity, fisheries resources and to offset the deterioration of ecosystem conditions. However, the effectiveness of these conservation efforts remains unclear.

Subtidal research, specifically at depths greater than 30 m, is extremely challenging and up until recently there have been very few methods capable of collecting unbiased and spatially comprehensive biodiversity data across the full depth range inhabited by the different species. As such, existing datasets are typically limited spatially (e.g. restricted to certain depth zones or geographic locations) and temporally. Although not unique to South Africa, the absence of comprehensive historic and current data to inform adaptive resource management can be viewed as a major hurdle to effective management of reef ecosystems.

The high latitude coral reefs of found in the iSimangaliso Wetland Park (IWP) MPA are the only coral ecosystems in South Africa and support unique biodiversity and important fisheries resources. The IWP MPA is large with well-established no-take Sanctuary Zones (St Lucia Sanctuary and Maputaland Sanctuary) and Restricted Zones that preclude bottom fishing. While there has been considerable research on the shallow reefs in the IWP, there has been little standardised research in the deeper environments. Furthermore, there is concern that the ecological condition of the northern reefs in the Maputaland Sanctuary Zone of the IWP is deteriorating.

This project aims to determine the role of depth in structuring the macrobenthic and fish assemblages in the IWP MPA and to conduct a comparative assessment of the MPAs’ different management zones to quantify differences in ecosystem condition.

OBJECTIVES

Determine the community composition of sessile macroinvertebrates, elasmobranchs and bony fish occurring on photic (10–40 m) and mesophotic (40–250 m) reefs in the iSimangaliso Wetland Park and on adjacent exploited reefs. Determine the effect of depth on the community composition of reef-associated sessile macroinvertebrates, bony fish and elasmobranchs. Define benthic biotypes between 10 to 250 m depth and investigate whether specific assemblages of fish and/or elasmobranchs associate with the different biotypes. Employing various measures of ecosystem (e.g. species and functional diversity) and population (e.g. species abundance and size structure) health, test if the ecosystem condition in the Maputaland Sanctuary is different from that measured in the St. Lucia Sanctuary (what we would expect from a healthy ecosystem), the IWP MPA restricted zones (what we would expect from a recovering ecosystem), and southern Mozambique (what we would expect from a degraded ecosystem).

PROGRESS

Data collection was conducted during 2016 and 2017, with the final field trip planned for June 2018. Sample processing is expected to be completed by the end of 2018. Population structure data for important fisheries species collected during the first fieldtrip (November 2016) was used by a BSc Honours student to test for recovery in the IWP MPA Restricted Zone relative to the St. Lucia Sanctuary Zone. The results demonstrated that, although abundances were comparable between the management zones, the size of fish were significantly larger in the Sanctuary Zone than in the Restricted Zone.
23. DEVELOPMENT OF SAMPLING TECHNOLOGIES TO SURVEY DEEP REEF FISH ASSEMBLAGES

Programme leader: Dr A. Bernard, Dr S. Kerwath

Source of funds: National Research Foundation Research Technology Fund

Duration of project: 2016 - Present

BACKGROUND

There is an urgent need to conduct nationwide fisheries independent assessments of reef fish populations to support management. While the fish occupying the nearshore, shallow water environments are easily sampled, accessing the fish populations inhabiting deep reefs located on the outer regions of the continental shelf and beyond is more complicated. These regions are best accessed by medium (13–20 m length) or large (>20 m length) research vessels as the water depth, strong currents, and isolation makes working off small research vessels unsafe and impractical.

Baited remote underwater stereo-video systems (stereo-BRUVs) are considered to be the optimal method to conduct these fisheries independent surveys. Stereo-BRUVs are associated with low levels of data variability, have higher detectability probabilities for reef fish than traditional methods and are a standardised method that can be employed across the full depth distribution of a species (e.g. 10–200 m = red stenbras).

Stereo-BRUVs surveys of reef fish populations from the nearshore regions of South Africa’s continental shelf (<85 m water depth) have successfully been conducted off small research vessels (<9 m length). This has resulted in the development of detailed standard operating procedures (SOPs) that are adequate to facilitate national research objectives of inshore reefs. However, attempts to employ the systems and SOPs off larger vessels have not been as successful, resulting in equipment loss and cancellation of research projects. The overriding factor attributed to this failure is the inappropriate design of the stereo-BRUVs for sampling on deep reefs in high ocean currents and off medium and large research vessels. In addition to this, the lack of SOPs for safe deployment and retrieval of the stereo-BRUVs on deep reefs complicate the matter further.

This project aims to develop technologies and SOPs to address this research gap and facilitate future research on line-fisheries resources occupying deep reef habitats.

OBJECTIVES

1. Design, test and optimise the performance of a stereo-BRUVs that is suitable for conducting research at depths greater than 100 m, off medium (13–20 m length) and large (>20 m length) research vessels, and in high ocean current conditions.

2. Develop optimised sampling protocols with a focus on (i) deployment time and (ii) sample size for stereo-BRUVs surveys in deep waters.

3. Develop a comprehensive SOP for deep-water stereo-BRUVs research off medium and large research vessels, and in high current conditions.

4. Conduct a comparative field experiment to determine whether or not fish population data collected with the prototype deep-water stereo-BRUVs are comparable to data collected with the shallow-water stereo-BRUVs.

PROGRESS

We have developed and successfully tested an untethered stereo-BRUVs (i.e. one that does not have ropes connecting it to buoys on the sea surface) capable of working down to 1110 m depth. This untethered stereo-BRUVs uses a built-in ballast system, controlled by remotely operated acoustic-release transponders, and syntactic foam buoyancy to control its descent and ascent from the seafloor. This new technology will allow us to work in more challenging marine environments and greatly broaden the scope for future deep-sea research at NRF-SAIAB and in South Africa.

Standardisation of the sampling equipment design and sampling protocols between shallow and deep systems is critical to allow unbiased comparisons of shallow and deep-water populations and communities. Comparative assessment revealed that the optimal deployment time was higher to assess shallow (10–30 m) and deeper water (30–150 m) fish assemblages. On the other hand, optimal sample size depended on the variability in fish species, abundance of uncommon species, patchy distribution, which require greater sampling effort to sample adequately.

The SOPs for working off larger vessels are under development and will be completed by the end of 2018, following the completion of the comparative field experiments.
24. CONSERVATION BIOLOGY AND FISHERIES STUDIES IN SOUTHERN AFRICA

**Project leader:** Prof. O.L.F. Weyl

**Project researchers:** Dr B.R. Ellender, Dr R. Peel, Dr G. Taylor, Dr S. Marr

**Source of funds:** SANBI, NRF, Centre for Invasion Biology (CIB), South African National Parks (SANParks), WRC, African Parks

**Duration of project:** 2009 – ongoing

**BACKGROUND**

Effective conservation of aquatic ecosystems requires a holistic understanding not only of the ecology, biology and life history of the organisms within the ecosystem, but also of the social and economic needs of the communities that utilise ecosystem services. Conservation biology research is therefore multi-disciplinary and includes biological studies on indigenous fishes and their parasites, assessments of fish utilisation, and genetic surveys.

**OBJECTIVES**

To develop a holistic understanding of the threats to freshwater fishes and the ecosystems upon which they depend so that proactive management strategies can be developed for their conservation and sustainable utilisation.

**PROGRESS**

Research on the ecology of fishes and sustainable utilisation in Africa continues with projects in South Africa, Mozambique, Namibia, Botswana and South Africa. Modiegie Bakane completed his MSc on evaluating protected areas as management tools in the Chobe District of Botswana. In the Zambezi Region of Namibia, collaborative research between NRF-SAIAB, the Namibia Nature Foundation (NNF) and the University of Namibia investigated environmental and human impacts on the fish and fisheries of the eastern Caprivi floodplains, with particular emphasis on the development of the Lake Liambezi fish stocks following the refilling of the lake. Both PhD students on this project, Geraldine Taylor and Richard Peel graduated in 2017.

In South Africa, the group completed a review on the available knowledge of the fishes of the Cape Fold Ecoregion and contributed to a major work on informing global policies on dam removals. The main point of that manuscript is that the impact of dams is context specific and, in arid climates, dams may act as refugia for some threatened species. Regionally, we continued with a project to provide a biodiversity baseline for the newly proclaimed Lake Niassa aquatic reserve together with the World Wide Fund for Nature – United States of America (WWF-USA) and Mozambique. Globally, the group contributed towards developing frameworks for global monitoring systems under the Future Earth BioDiscovery framework.

**FUTURE WORK**

Developing policy guidelines for inland fisheries development in South Africa and developing conservation strategies for aquatic ecosystems and fisheries, both locally and regionally.

**SELECTED PUBLICATIONS/REPORTS**


25. ALIEN FISH INVASION BIOLOGY IN SOUTH AFRICA

Project leader: Prof. O.L.F. Weyl

Project researchers: Prof. O.L.F. Weyl, Dr D. Woodford, Dr R. Wasserman, Dr B.R. Ellender, Dr M. Alexander, Mr T. Bellingan, Mr L. Mofu, Dr S. Marr

Source of funds: NRF, CIB, SANBI, South African and Netherlands Partnership for Development (SANPAD), Water Research Commission (WRC)

Duration of project: 2005 – ongoing

BACKGROUND

Alien invasive fishes play a major role in southern African aquatic ecosystems. Understanding the pathways of introduction and subsequent impacts of alien invasive fishes on these ecosystems is therefore important in developing strategies for their management.

OBJECTIVES

To conduct research into aquatic invasive organisms to understand the nature and extent of impacts on biodiversity and to help solve problems created by such invasions.

PROGRESS

With the publication of the National Environmental Management: Biodiversity Act (NEM:BA) Invasive species lists in 2014, the NRF-SAIAB freshwater ecology group has been working to provide the Department of Environmental Affairs (DEA) and SANBI with updated information to support their risk analysis strategy for invasive alien fishes. The group is also working on a collaborative research exercise to better understand the complexities of invasive species management. This has resulted in contributions to papers informing on invasion risk, management frameworks and dealing with conflict species.

On the Rondegat River, NRF-SAIAB has been monitoring native fish recovery rates following the removal of alien fishes in 2012. This work has demonstrated that alien fish eradication had very significant benefits for native biota. A new project was secured from the Water Research Commission to continue with long-term monitoring in the Rondegat River until 2019.

The NRF-SAIAB/CIB collaborative research project on determining the role of irrigation infrastructure in mediating alien invasion continued. This programme has used an irrigation network in the Sundays River catchment as a natural experiment to understand the drivers of fish species establishment.

Additional NRF-SAIAB/CIB/QUB collaborative research projects involved an assessment of the predatory roles of fish species within the context of invasion biology. Since it is postulated that predatory success is one of the drivers of invasion success, the predation strength of selected non-native and native fish species were assessed and compared using a functional response approach.

FUTURE WORK

Understanding invasion mechanisms and processes as well as continued research on invasion risk.

SELECTED PUBLICATIONS/REPORTS


Project leader: Prof. O.L.F. Weyl

Project researchers: Prof. O.L.F. Weyl, Mr D. Khosa, Mr L. Mofu, Ms N. Matam, Mr P. Mochechela, Mr C. Broome, Ms M. Truter, Dr S. Hugo, Dr J. Hean, Dr J. South, Dr S.M. Marr

Source of funds: DST/NRF SOUTH AFRICAN RESEARCH CHAIRS INITIATIVE (SARChI)

Duration of project: 2017 – ongoing

BACKGROUND

In August 2017 NRF-SAIAB was awarded a SARChI in Inland Fisheries and Freshwater Ecology. The primary aims of the SARChI are:

- Through a strong focus on applied research and student training, to develop internationally competitive science that will result in a higher level of understanding of the underlying biological and ecological processes in African freshwater fisheries and their response to human-induced stressors (e.g., overfishing, habitat loss, pollution, the changing climate, and species invasions) to inform ecologically, economically and socially sustainable fisheries resource utilisation.

- To develop regional capacity in inland fisheries and freshwater ecology that are strongly aligned to the national goals of transformation and redress in the science sector.

OBJECTIVES

The strategy is to contribute core research on ecological traits, fisheries ecology, invasion biology and policy support (including applied research to support to the emerging South African fisheries policy) and to support fisheries development and policy implementation in South Africa.

With regard to ecological traits, the major objective of the Chair is to develop a database on the ecological traits of freshwater fishes in southern Africa, to facilitate comparisons between African systems, and to contribute to syntheses and large-scale analyses of the response of fish communities to global change. The focus will be on the four main freshwater ecoregions of southern Africa: the Cape Fold, southern Temperate Highveld, Okavango and upper Zambezi Ecoregions.

In the field of fisheries ecology, the objective is to use the database on ecological traits and, by undertaking novel research in aquatic ecosystems ranging from larger lakes, rivers and floodplains, to small irrigation impoundments, provide a better understanding of the dynamics of African inland fisheries, facilitate regional analyses and contribute to global analyses of the response of fish communities to fishing.

In the field of invasion biology, the objective is to increase understanding of the role of alien fish introductions for fisheries, the risk of invasions, and subsequent ecological consequences which is essential for developing management strategies to limit the impact on native biota while maximising economic and food security benefits. Under the Chair, research will therefore be directed at better understanding alien fishes in southern African ecosystems from ecological, societal and economic perspectives.

Fisheries policy support will be provided by developing collaborations with research groups both nationally (e.g., University of the Western Cape; Department of Economics at Rhodes University and North West University) and internationally (e.g., FAO, Leibniz Institute for Freshwater Ecology and Inland Fisheries, Germany) to enhance our understanding of the social and economic influences on fisheries to better contextualise the consequences of evolving environmental legislation and fisheries policy on society. Research will be geared at improving understanding of the value chains associated with inland fisheries and the contribution of different fishing sectors (recreational, subsistence and commercial) to local and national economy and livelihoods.

PROGRESS

Outputs in 2017 include the publication of five papers under the SARChI; the presentation of the state of fisheries in Lake Malawi at the Great Lakes of Africa Conference, Uganda; presentation of research on native fish responses to predator release at the Fisheries Society of the British Isles, and presentation of research on Black Bass in southern Africa at the American Fisheries Society conference. A collaboration workshop on functional responses with Queens University Belfast (QUB) resulted in hosting QUB collaborator Ross Cuthbert for a six-month research visit (2017/18) to NRF-SAIAB to conduct research on functional responses.
27. SUPPORT FOR AFRICAN FISH AND FISHERIES RESEARCH, MANAGEMENT AND CONSERVATION

Programme leader: Mr D. Tweddle

Source of funds: NRF, NRF-SAIAB, IUCN, AWF, NORAD/WWF/NNF, NEPAD BioFISA Project, NorConsult

Duration of project: 1995 – ongoing

BACKGROUND

Prior to joining NRF-SAIAB as an Honorary Research Associate in 1995, Mr Tweddle was employed for 22 years in fish and fisheries research in Malawi, during which time he maintained close links with NRF-SAIAB. Numerous surveys contributing to the NRF-SAIAB National Fish Collection have since been conducted in most of the southern/eastern African countries for many different agencies. These contribute to taxonomic studies and biodiversity conservation recommendations. Mr Tweddle is also extensively involved in fisheries research and management projects in eastern and southern Africa.

OBJECTIVES

To identify and describe fishes from south eastern Africa, and assist neighbouring countries in fisheries research, fisheries management and biodiversity conservation.

PROGRESS

Several new species were described by NRF-SAIAB scientists and collaborators from trawl surveys made by Mr Tweddle off the Angolan coast and from the Mascarene Plateau in the Indian Ocean between Mauritius and the Seychelles. Under NRF-SAIAB auspices, fish surveys were made of the upper Zambezi system including the Liwu Plain National Park in Zambia, Malawi, Swaziland, Botswana and Lesotho, and under other fisheries projects and EIAs in Kenya, Tanzania, Namibia and Liberia. New freshwater fish species have been described from Malawi. Mr Tweddle also plays a major role in the IUCN/NRF-SAIAB/SANBI freshwater organisms’ Red Data assessments. A paper was published on the distribution and conservation status of the Caprivi killifish.

The NRF-SAIAB components of the four-year, European Union (EU) funded project entitled “Community Conservation Fisheries in Kavango-Zambezi Transfrontier Conservation Area (KAZA), Project” came to an effective close at the end of 2016. Results from the research undertaken jointly through NRF-SAIAB, University of Namibia, and the Namibian Ministry of Fisheries and Marine Resources (MFMR), Southern Africa Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) and GoGreen are now being published, with the successful PhD theses of Richard Peel and Geraldine Taylor leading to papers that are highlighted in Chapter 24 and the publications list in this annual report.

Descriptions of many new species are in various stages of progress.

SELECTED PUBLICATIONS/REPORTS


**APPENDIX 1**

**NRF-SAIAB RESEARCH OUTPUTS (2017)**

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


77. Nhiwatiwa, T., Maseko, Z. & Dalu, T. 2017. Fish communities in small subtropical reservoirs subject to extensive drawdowns, with focus on the biology of *Euteromius pauludinosus* (Peters, 1852) and *Clarias gariepinus* (Burchell, 1822). Ecological Research 32(6), 971–982.


**OTHER REFEREED (PEER-REVIEWED) SCIENTIFIC PAPERS**


**BOOKS, BOOK CHAPTERS AND BOOK REVIEWS**


REPORTS AND THESES

POPULAR ARTICLES AND OTHER PUBLICATIONS

CONFERENCE AND SYMPOSIUM PRESENTATIONS
of managing South Africa’s national acoustic telemetry array’. 4th International Conference on Fish Telemetry, Cairns, Australia.


PUBLIC PRESENTATIONS

## APPENDIX 2

### LIST OF ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABIC</td>
<td>African Biodiversity Information Centre</td>
</tr>
<tr>
<td>ACEP</td>
<td>African Coelacanth Ecosystem Programme</td>
</tr>
<tr>
<td>AERP</td>
<td>Aquatic Ecophysiology Research Platform</td>
</tr>
<tr>
<td>AFGP</td>
<td>Antifreeze Glycoprotein</td>
</tr>
<tr>
<td>AMBEC</td>
<td>Aquatic Marine Biodiversity and Ecosystem Conference</td>
</tr>
<tr>
<td>ATAP</td>
<td>Acoustic Tracking Array Platform</td>
</tr>
<tr>
<td>AWF</td>
<td>African Wildlife Foundation</td>
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<tr>
<td>BioFISA</td>
<td>The Finnish-Southern African partnership programme to Strengthen NEPAD/SANBio</td>
</tr>
<tr>
<td>BOLD</td>
<td>Barcode of Life Database</td>
</tr>
<tr>
<td>BRUVs</td>
<td>Baited remote underwater video systems</td>
</tr>
<tr>
<td>CAPTOR</td>
<td>Connectivity and dispersal between protected areas</td>
</tr>
<tr>
<td>CBOL</td>
<td>Canadian Barcode of Life</td>
</tr>
<tr>
<td>CFE</td>
<td>Cape Fold Ecoregion</td>
</tr>
<tr>
<td>CFWIO</td>
<td>Coastal Fishes of the Western Indian Ocean</td>
</tr>
<tr>
<td>CIB</td>
<td>Centre for Invasion Biology</td>
</tr>
<tr>
<td>COI</td>
<td>cytochrome c oxidase subunit I</td>
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<tr>
<td>CODATA</td>
<td>Committee on Data for Science and Technology</td>
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<tr>
<td>COST</td>
<td>Coastal and Ocean Sciences Team</td>
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<tr>
<td>CPRR</td>
<td>Competitive Programme for Rated Researchers</td>
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<tr>
<td>CPUT</td>
<td>Cape Peninsula University of Technology</td>
</tr>
<tr>
<td>CSIR</td>
<td>Council for Scientific and Industrial Research</td>
</tr>
<tr>
<td>CToL</td>
<td>Cyprinid Tree of Life</td>
</tr>
<tr>
<td>DEA</td>
<td>Department of Environmental Affairs</td>
</tr>
<tr>
<td>DAFF</td>
<td>Department of Agriculture, Forestry and Fisheries</td>
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<tr>
<td>DIFS</td>
<td>Department of Ichthyology and Fisheries Sciences (Rhodes University)</td>
</tr>
<tr>
<td>DST</td>
<td>Department of Science and Technology</td>
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<tr>
<td>EEZ</td>
<td>Exclusive Economic Zone</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EU</td>
<td>European Union</td>
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<td>FAD</td>
<td>Fish Aggregating Device</td>
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<td>FAO</td>
<td>Food and Agriculture Organization (of the United Nations)</td>
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<tr>
<td>FBIP</td>
<td>Foundational Biodiversity Information Programme (NRF-FBIP)</td>
</tr>
<tr>
<td>FISH-BOL</td>
<td>Fish Barcode of Life Initiative</td>
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<tr>
<td>HBUs</td>
<td>Historically Black Universities</td>
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<td>HCD</td>
<td>Human Capital Development</td>
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<td>HKUST</td>
<td>Hong Kong University of Science and Technology</td>
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<tr>
<td>IBOL</td>
<td>International Barcode of Life Project</td>
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<tr>
<td>IBT</td>
<td>Inter-Basin Water Transfer</td>
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<td>ICAIS</td>
<td>International Conference for Aquatic Invasive Species</td>
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<tr>
<td>ICEFISH</td>
<td>International Collaborative Expedition to study Fish Indigenous to Sub-Antarctic Habitats</td>
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<td>IDRC-IBOL</td>
<td>International Development Research Centre – International Barcode of Life Project/</td>
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<td>IFS</td>
<td>International Foundation for Science</td>
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<tr>
<td>IMR</td>
<td>Institute of Marine Research – Norway</td>
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<tr>
<td>IRD</td>
<td>Institut de recherche pour le développement</td>
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<tr>
<td>IUCN</td>
<td>International Union for the Conservation of Nature</td>
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<tr>
<td>IWP</td>
<td>iSimangaliso Wetland Park</td>
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<td>KAZA</td>
<td>Kavango-Zambezi Transfrontier Conservation Area</td>
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<td>KZN</td>
<td>KwaZulu-Natal</td>
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<tr>
<td>MBZ</td>
<td>Mohamed bin Zayed Fund for Nature Conservation</td>
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<tr>
<td>MFA</td>
<td>Ministry of Foreign Affairs – Finland</td>
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<tr>
<td>MFMR</td>
<td>Ministry of Fisheries and Marine Resources – Namibia</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
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<tr>
<td>MPA</td>
<td>Marine Protected Area</td>
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<tr>
<td>MRAC</td>
<td>Musee Royale Afrique Centrale</td>
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<tr>
<td>MRAG</td>
<td>Marine Resources Assessment Group</td>
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<td>MSP</td>
<td>Marine Spatial Planning</td>
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<tr>
<td>NEM-BA</td>
<td>National Environmental Management: Biodiversity Act</td>
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<td>NEPAD</td>
<td>The New Partnership for Africa's Development</td>
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<td>NIRC</td>
<td>Network of Italian Researchers in the Cape</td>
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<tr>
<td>NISC</td>
<td>National Information Services Centre</td>
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<td>NGS</td>
<td>Next Generation Sequencing</td>
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<td>NMU</td>
<td>Nelson Mandela University</td>
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<td>NMNZ</td>
<td>National Museum of New Zealand</td>
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<tr>
<td>NNF</td>
<td>Namibia Nature Foundation</td>
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<td>NORAD</td>
<td>Norwegian Agency for Development Cooperation</td>
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<td>NRF</td>
<td>National Research Foundation</td>
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<tr>
<td>NRF-CPRR</td>
<td>National Research Foundation Competitive Programme for Rated Researchers</td>
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<td>NRF-FBIP</td>
<td>National Research Foundation Foundational Biodiversity Information Programme</td>
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<td>NRF-IFRR</td>
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<td>NRF-KIC</td>
<td>National Research Foundation Knowledge Interchange and Collaboration</td>
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<td>National Research Foundation Research and Technology Fund</td>
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<td>NRF-SAEMON</td>
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<td>NRF-SAIAB</td>
<td>South African Institute for Aquatic Biodiversity</td>
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<td>OTN</td>
<td>Ocean Tracking Network</td>
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<td>ORI</td>
<td>Oceanographic Research Institute</td>
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<td>PDP</td>
<td>Professional Development Programme</td>
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<td>QUB</td>
<td>Queens University Belfast</td>
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<tr>
<td>ROV</td>
<td>Remotely Operated Vehicle</td>
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<tr>
<td>RTF</td>
<td>Research and Technology Fund</td>
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<td>RU</td>
<td>Rhodes University</td>
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<td>Rhodes University Joint Research Council</td>
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<td>R/V</td>
<td>Research Vessel</td>
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<td>SAAMBR</td>
<td>South African Association for Marine Biological Research</td>
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<td>SANAP</td>
<td>South African National Antarctica Programme</td>
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<td>Southern African Network for Biosciences</td>
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<td>South Africa-Norway Research Cooperation on Climate Change, the Environment and Clean Energy</td>
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<td>SANCOR</td>
<td>South African Network for Coastal and Oceanic Research</td>
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<td>SANPAD</td>
<td>South African and Netherlands Partnership for Development</td>
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<td>SANParks</td>
<td>South African National Parks</td>
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<td>SARCHI</td>
<td>South African Research Chairs Initiative</td>
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<td>SASSCAL</td>
<td>Southern Africa Science Service Centre for Climate Change and Adaptive Land Management</td>
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<tr>
<td>SDR</td>
<td>SensorDish® Reader</td>
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<tr>
<td>SOP</td>
<td>Standard operating procedure</td>
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<td>SOSF</td>
<td>Save Our Seas Foundation</td>
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<td>SWIO</td>
<td>South West Indian Ocean</td>
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<td>UFH</td>
<td>University of Fort Hare</td>
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<td>University of Zululand</td>
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<td>United States of America</td>
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<td>UWC</td>
<td>University of the Western Cape</td>
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<td>WIO</td>
<td>Western Indian Ocean</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>WIOMSA</td>
<td>Western Indian Oceans Marine Science Association</td>
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<td>WIOMSA - Marine Science for Management</td>
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<td>Water Research Commission</td>
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<td>WSU</td>
<td>Walter Sisulu University</td>
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<td>WWF</td>
<td>World Wide Fund for Nature</td>
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<td>World Wide Fund for Nature – South Africa</td>
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<td>WWF-USA</td>
<td>World Wide Fund for Nature – United States of America</td>
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</table>
Above: ACEP ROV high definition camera captures the beauty of life on deep reefs (Photo: ACEP ROV with Ryan Palmer and Kerry Sink)

Back cover: Prof Olaf Weyl, Senior Scientist at NRF-SAIAB, with Roxanne Erusan, Biotechnician at Addo Elephant National Park and students, Avuzwa Bomvana and Christoff Heidmann, preparing a fyke net for a sampling trip up the Wit River (Photo: Lucky Dlamini)