

Report unearths rich history of SA FRESHWATER SCIENCE



Courtesy FRU

A momentous report on the history and status of the freshwater science in South Africa has not only recorded this sector's remarkable journey over the last 100 years, but revealed serious threats to the science's endurance and continued impact towards the sustainable development and management of the country's water resources. Report compiled by Lani van Vuuren.

The effective management of South Africa's water resources requires an informed and reliable scientific foundation to provide appropriate evidence-based information to guide decision-making. Aquatic sciences, together with engineering, provide this foundation and help to ensure that the country's water resources are managed sustainably.

South Africa has a proud history of research in aquatic sciences that can be traced back to the start of the twentieth century. A recently completed study, funded by the Water Research Commission (WRC), set out to record the evolution of aquatic sciences in South Africa since 1900,

identify the external driving forces that helped to direct research, pinpoint the individuals and institutions responsible for shaping the ways in which aquatic sciences developed, and determine the extent to which aquatic sciences have contributed to effective management of South Africa's water resources.

The result is a first-of-its-kind report for South Africa. The report, *The freshwater science landscape in South Africa, 1900-2010*, provides a broad overview of the evolution of South African aquatic science from its early years up to the present day, focusing specifically on inland surface waters. The study was led by Drs Peter Ashton of the CSIR and

Dirk Roux of South African National Parks, with inputs from a host of the country's top aquatic scientists.

The report illustrates how in the early 1900s, the primary focus of aquatic science was directed at taxonomic work as investigators sought to identify and classify the variety of new organisms they encountered. From that time South African aquatic science slowly developed to its present form where the hydrological and biophysical characteristics of inland waters have to be integrated with the social, economic and political issues related to the uses that are made of the country's scarce water resources.

THE EARLY YEARS (1900 – 1945)

Only a handful of aquatic researchers (mostly trained overseas) practiced their trade in South Africa during the early years. These men and women were all pioneers and innovators, finding the ways and means to conduct their research with very little support in terms of instrumentation, facilities and finances. The one resource that these scientists had was time, as well as almost complete freedom to carry out research on topics of their own choice.

MIDDLE YEARS (1946 – 1979)

The middle years brought organisational structure to the science enterprise in South Africa, with the newly established Council for Scientific and Industrial Research (CSIR) playing a pivotal role in this regard. Related developments include the establishment of the Limnological Society of Southern Africa (1963), Institute for Freshwater Studies (1964), JLB Smith Institute of Ichthyology (1968), WRC (1971) and the Department of Water Affairs Hydrological Research Institute (1972).

Important research programmes were started during this era, notably

the National Programme for Environmental Sciences in 1972 and the Cooperative Scientific Programmes (CSPs) in 1975. The Water Act (1956) and the publication of the very influential report by the Commission of Enquiry into Water Matters (1970) provided national direction.

A growing appreciation for the inherent connectedness of biophysical systems and acceptance of the concept of ecosystems spawned a global initiative, the International Biological Programme, to coordinate large-scale ecological and environmental studies. South Africa responded to this international movement by establishing the National Programme for Environmental Sciences (NPES). This was a very significant event in the chronology of aquatic science because it provided, for the first time, a national vision that was to become a rallying point around which researchers could build learning relationships.

This era of the national programmes was characterised by collaboration across the country while individual researchers and groups were encouraged to become internationally competitive. The administrators gave considerable attention and support to profiling the researchers and research conducted under the banner of the NPES. This grew the confidence of scientists.

The period of the Cooperative Scientific Programmes (CSPs), which followed up the NPES, also stands out as a period of relatively high cohesion among aquatic scientists in the country. The depth and breadth of scientific research that resulted from these programmes is unequalled up to this day.

A number of field stations were established around the country, which provided excellent facilities for academic supervisors to take students into the field and expose them to the realities of specific aquatic systems. These practical extensions of the lecture hall made a significant difference in the training and enthusiasm of students and often provided the fuel for passion and getting students 'hooked' on a career in science.

TURBULENT TRANSITIONAL YEARS (1980 – 1994)

External pressures, such as the drive to commercialise research and a certain degree of international isolation, together with the internal demise of the CSPs, had a profound effect on the course of aquatic science in South Africa after 1980. In a sense, the 1980s spelled the end of what many consider to have been the 'golden era' of aquatic research in South Africa, and it would take some



Courtesy FRU

Students at the University of Cape Town's Freshwater Research Unit undertaking a river sampling exercise. Nowadays site work has become a luxury rather than a necessary in aquatic science research.

EXCEPTIONAL INDIVIDUALS OF THE PAST

Mary Agard Pocock (1886-1977)



Mary combined her unusual talents in art and science in the study of botany. Educated in England, she had an adventurous spirit, joining ethnologist, Dorothea Bleek, in 1925 for a six-month journey on foot from Livingstone in northern Rhodesia (now Zambia) through the Barotse floodplains of the upper Zambezi, and then through Angola to Luanda. Pocock is best known for her pioneering research on the Volvocales. Her 'outstanding work on algae' was recognised in 1957 when she received the Crisp Medal and Award from the Linnaean Society of London and later in 1967, when Rhodes University conferred on her an honorary Doctorate in Science.

Keppel Harcourt Barnard (1887-1964)



Keppel was born and schooled in London. He joined the South African Museum in Cape Town as an assistant in 1911, working his way up to become Director in 1946. Keppel was a taxonomic 'polymath', publishing over 200 papers on the taxonomy of various freshwater species. He mounted several collecting expeditions to remote places, including the coast of Portuguese East Africa (now Mozambique) and the Kunene River in northern Zambia, some of them by oxwagon. Keppel is described as one of the last breed of biologists who had both the breadth and depth of knowledge to make him conversant with almost all animal taxa.

George Evelyn Hutchinson (1903-1991)

George was born and educated in England. In 1925 he was hired on a three-year contract as a



temporary lecturer at the University of the Witwatersrand. After a year of teaching he worked on pans in the eastern portion of the Highveld and elsewhere, publishing the first significant paper on South African limnology in 1932. He later left South Africa to join Yale University as a postdoctoral fellow where he taught for 43 years. He is widely regarded as one of the founding fathers of aquatic ecology.

Eduard Meine van Zinderen Bakker (1907-2002)



Born and educated in the Netherlands, Eduard emigrated to South Africa in 1947 where he joined the Department of Botany at the University of the Free State. He initiated limnological research on the Orange River system and, in 1965, on the sub-Antarctic islands of Marion and Prince Edward. Some months before he died, he expressed his philosophy as follows: "The most valuable legacy we can leave to our fellow humans, young and old, is the overwhelming awareness that we are surrounded by countless wonders that do not ask for pseudo-explanations, but can only be answered in a manner that befits the marvels of nature, namely with reverence and with a huge question mark."

John Hemsworth Osborne Day (1909-1989)



John was born in England, but was brought up in Mozambique and later South Africa. Following studies in South Africa he completed his PhD through Liverpool University. In the mid-1930s, John was employed at the University of Cape Town (UCT), first as research assistant

and later as a lecturer. Almost single-handed, John surveyed the invertebrate fauna of the rocky shores of southern Africa from Lüderitz to northern KwaZulu-Natal. When World War II broke out in 1939, John returned to the UK to join the Royal Air Force where he lost his leg. Returning to UCT after the war, he developed the first estuarine research programme in southern Africa. John believed that good fundamental data are essential for understanding the functioning of aquatic ecosystems, and his surveys of the rocky shores, inshore waters and estuaries of South Africa are still models of good practice equalled in very few parts of the world.

Katherine Marjorie Frances Scott (1913-1998)



Marjorie obtained her PhD at the University of Cape Town (UCT) in 1939. After living for some years in Argentina, she returned to South Africa at the start of World War II, to the Department of Zoology at UCT, during which time her research switched to estuaries. She later moved to the National Institute of Water Research (NIWR) of the CSIR where she worked until her retirement in 1978. Here she turned her attention to freshwater biology. Marjorie found herself increasingly drawn to taxonomic studies, firstly of adult chironomids and caddis flies, which gradually became her main interest. Marjorie was a brilliant scientific illustrator, and she left a legacy of drawings that are scientifically accurate and aesthetically pleasing. She continued her work on caddis flies on a voluntary basis after she retired right up to her death at the age of 85.

Arthur Desmond Harrison (1921-2007)

Arthur was born in Kalk Bay near Cape Town. He obtained his PhD from UCT. His work on the



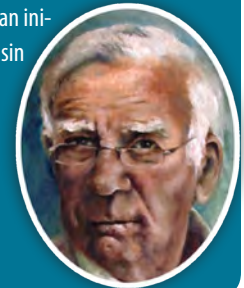
Arthur's aquatic ecology of the Great Berg River, published in the *Transactions of the Royal Society of South Africa*, was the earliest on South African rivers and represented some of the earliest significant publications on the ecology of rivers anywhere. Arthur joined the NIWR, and later took up a Rockefeller Grant for bilharzia research at the University of Rhodesia in Salisbury. Later he returned to South Africa, briefly becoming Professor of Zoology at the University of Natal before accepting a professorship in Biology at the University of Waterloo in Canada. During all these years he had a particular interest in non-biting midges, publishing many papers, especially on the South African fauna.

Arthur was an immensely knowledgeable, insightful and productive scientist and a charming person. He was a limnological pioneer in Africa when the field was in its infancy.

Prof Brian Allanson (1928 –)

Brian, to whom the WRC report is dedicated, was born in Sri Lanka. He moved with his family to Port Elizabeth as a young boy, and attended Grey High School, in Port Elizabeth. After qualifying in Zoology and Chemistry at the University of Natal in 1948, Brian accepted a post at Hilton College as assistant science master. He then went to UCT to obtain his MSc in Marine Biology in 1954. He joined the UCT Zoology Department in 1955. In 1963, Brian was appointed Professor and Head of the Department of Zoology and Entomology at Rhodes University, the youngest Professor ever to have been appointed there. Two years later he became the first Director of the university's Institute for

Freshwater Studies. This group has played a seminal role in the investigation of the physics, chemistry and biology of coastal lakes and estuaries, notably Lake Sibaya and the Kosi lake system in KwaZulu-Natal and the coastal lakes of the Southern Cape. Brian retired from the Chair of Zoology at Rhodes in 1988. He served as Dean of the Faculty of Science for some years, as Chair of the Research Committee, and as the first Dean of Research. Following retirement, Brian with his wife moved to Knysna, where he established a small practice as a consulting aquatic ecologist, which he continues to this day. In 1995, Brian initiated the Knysna Basin Project, a research programme to assess the environmental condition of the Knysna estuary.



time for a new order to emerge.

The transitional period is characterised by a number of post-CSP trends, including reduced fieldwork which is now seen as a 'nice to have'. Due to the high cost of fieldwork this trend has persisted and nowadays studies are commonly designed to require less fieldwork and focus more on desktop work.

During the period when the CSPs operated, there was a national vision for science; now it seemed that every organisation had to have its own vision and the vision for aquatic science as a whole seemed to have dimmed close to the point of extinction. With the commercialisation of science, human resources performance evaluation tools started to encourage research administrators to measure themselves less against the advancement of science and more against financial targets and organisational or short-term political objectives.

Lastly, it appears that support for careful, time-consuming PhD-type research diminished after the CSP

years, with contract research rising as an alternative. Many scientists became consultants to put bread on the table and to remain in the sector.

A positive memory of this period was the strong sense of cohesion among aquatic scientists across organisational boundaries as well as a synergistic relationship between aquatic scientists and a highly competent and motivated group of water resource managers (mostly engineers) from the Department of Water Affairs (DWA).

A second positive note was the important role that the WRC started, and continues, to play in facilitating knowledge production, sharing and management in the water sector. "The Commission was the life raft to aquatic sciences following the demise of the CSPs, and it has continued to be a lifeline to research in the aquatic field, not only by contributing the necessary funds for research but creating cohesion in the sector through its research review and reporting processes," notes Dr Roux.

THE LATTER YEARS AND CURRENT STATUS (1995-2010)

In the years after South Africa's first democratic elections comprehensive revision of the country's water legislation dominated the aquatic science scene, culminating in the National Water Act of 1998. Pervasive restructuring and name changes characterise the institutional landscape during this era.

From the middle-1990s, the River Health Programme enabled the collection of data that show, through State-of-River reports, the relatively poor state and ecological integrity of many South African river systems. This undesirable state of affairs was confirmed when South Africa's first National Spatial Biodiversity Assessment, conducted in 2004, found that the country's river systems are more threatened than terrestrial or marine ecosystems.

Science now found itself operating within a much more rigid set of



Delegates at the 1980 conference of the Limnological Society of Southern Africa.

hierarchical structures and bureaucratic management approaches. With these changes emerged more administrative responsibilities and a need to account at an ever-shrinking timeframe (e.g. more regular progress reports).

According to Dr Roux, the project team was concerned to see how tied up people have become with existing commitments and responsibilities, especially senior aquatic scientists who now hold managerial positions. "While we found aquatic scientists in general more than keen to share their memories and experiences for this report, many could simply not find the time to do so. In such a crowded work life, the question must be asked around how much space is left for reflection, creativity and originality?"

Also, despite a relatively large

number of trained aquatic scientists, few find employment that offer true research opportunities. Simply put, the South African aquatic science sector is in danger of becoming out of breath.

The importance of institutional stability in order to build that 'bank' of knowledge to deal with water challenges was another important factor revealed by the study. This principle applies to research centres and government departments alike. Several units and directorates that used to be rich breeding grounds for aquatic science no longer exist or seem to have lost the ability to fulfil this function. Eroded institutional memory caused by the loss of experienced staff has weakened the national capacity to use all the information that has been so proudly produced, the WRC report points out.



A working group committee gathering at the Sabie River during the height of the Kruger National Park Rivers Research Programme in the 1990s. The multi-year, multi-disciplinary research programme did much to bring aquatic scientists and stakeholders together.

QUO VADIS SOUTH AFRICAN AQUATIC SCIENCE?


The report concludes with a synopsis of the current status of aquatic science in South Africa and makes a number of recommendations to strengthen the sector and its impact going forward. These recommendations range from needs in the basic education system and the job market, to the essence of functional monitoring programmes and a national vision to guide the development and deployment of aquatic science in South Africa.

There lies an exciting and challenging time ahead for South Africa's aquatic scientists as the country continues to grapple with a myriad of water challenges. Aquatic scientists will increasingly be called upon to address societal needs related to their fields of expertise and they must be ready to contribute in this regard, the report points out. "Aquatic scientists will be required to move beyond the 'traditional' simple production of a set of results, and instead make sure that their results can be turned into solutions that will help to solve a particular problem experienced by society."

To order the report, *The freshwater science landscape in South Africa, 1900-2010. Overview of research topics, key individuals, institutional change and operating culture* (WRC Report

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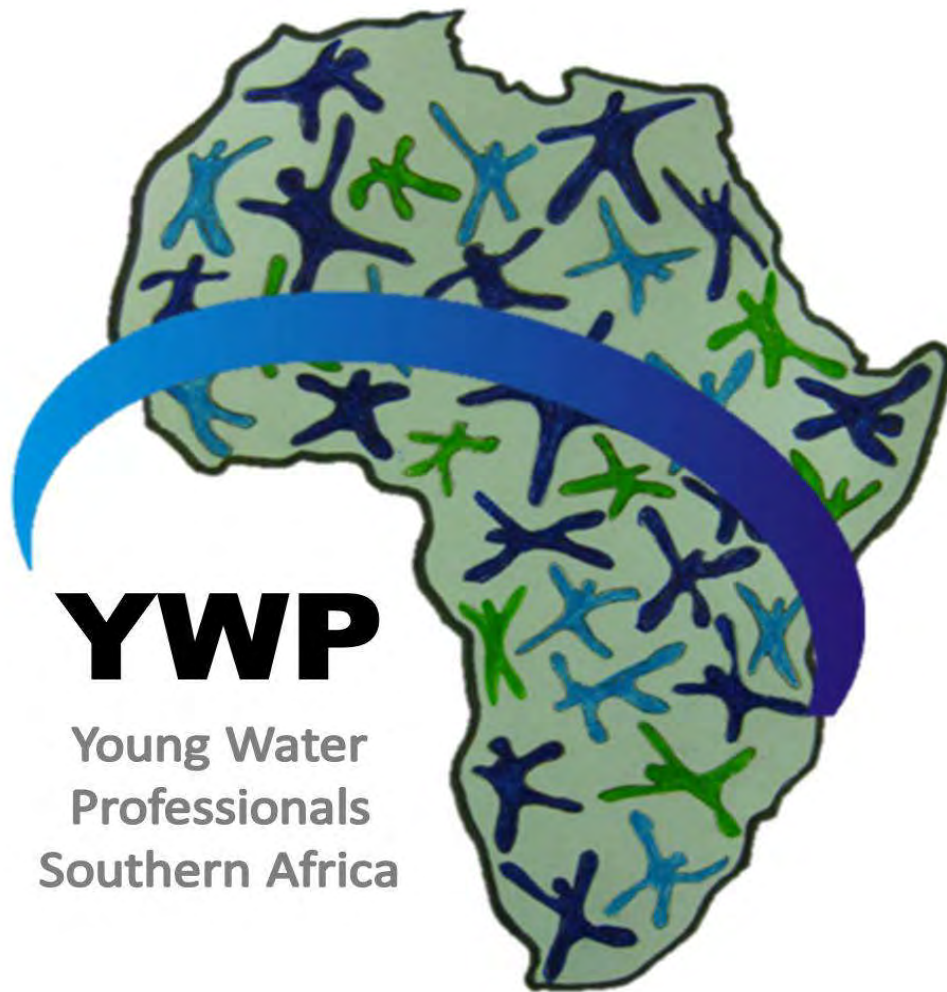
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