



All eyes on Olifants as EXPERTS SEARCH FOR ANSWERS

CSIR isotope technician Grant Hall displays an invertebrate sample to be analysed (All photographs by Lani van Vuuren).

What has been described as the most intensive operation yet to save a river system from total degradation is currently being undertaken in the Olifants River basin. Lani van Vuuren visited the catchment.

One of the country's hardest working rivers, the Olifants River, which flows through Mpumalanga and Limpopo on to Mozambique, has been subject to prolonged and cumulative ecosystem stress as a result of human activities in the catchment. While the river's plight first caught the attention of the public following the death of hundreds of crocodiles in the Loskop Dam and downstream in the Olifants River gorge situated in the Kruger National Park two years ago, its problems go back a lot longer than that. (For more on the crocodile deaths, see the article in the January/February 2009 issue of *the Water Wheel*).

Intensified irrigated agriculture, large-scale mining, power

generation, heavy industry and inadequate domestic sewage treatment have seen the river turn from a majestic water source into little more than a pollution drain in places. Fish kills have become commonplace over the last five years, especially in the area of the Loskop Dam. Most of the pollution occurs in the upper basin.

INTENSIVE EXAMINATION

Thankfully there are a handful of people who see the Olifants as a river worth saving. For the Olifants River Forum (ORF), a group of concerned individuals, organisations and companies that work and live in the catchment, things had deteriorated far enough. It was time to take drastic action and the non-profit organisation has contracted the CSIR to lead a three-year, multidisciplinary study to pin-point the pollution sources in the Upper Olifants River catchment with the view of making strong recommendations towards its remediation and restoration.

This is not the first research to be undertaken on the Olifants River.

Different scientific groups have, over the years, looked at different aspects in different reaches of the river. However, this study, known as the Olifants River Research Project, goes far beyond water quality.

This is the first time in South Africa that such a big team is looking at the ecological health of the entire ecosystem in the catchment and how that impacts on water quality, reports project leader Dr Paul Oberholster, limnologist at the CSIR. A team of about 30 scientists and government officials from the CSIR, the universities of Stellenbosch and Pretoria, the Department of Water Affairs and the Mpumalanga Tourism and Parks Agency have come together to tackle the problems of the catchment.

Oberholster explains that although the Upper Olifants River is affected by many variables, such a system is usually driven by a few controlling variables (e.g. heavy metals from acid mine drainage and high total phosphate concentrations from inflows of untreated to partially treated sewage). "With this study we aim to identify the critical variables

in the Upper Olifants River and its tributaries and to determine their thresholds.”

The project team is making use of a novel set of ecological indicators at different trophic levels (the position that an organism occupies in the food chain) as well as a comprehensive set of molecular techniques that provide accurate estimates of the ecosystem health in the study area. These data will be used to clearly identify the sources of different stressors and will be particularly useful to develop and refine appropriate water quality management responses, decision-making processes or remediation measures for the rivers in the Upper Olifants catchment.

The objective of this study, which has also received funding from

Coaltech, is not to point fingers or apportion blame. “This is a highly complex catchment and aquatic ecosystem, with many factors involved in creating the current situation. It is important that we sit together, look at the bigger picture and involve as many stakeholders as possible to restore the Olifants River,” notes Dr Oberholster.

FROM PHYTOPLANKTON TO ISOTOPES

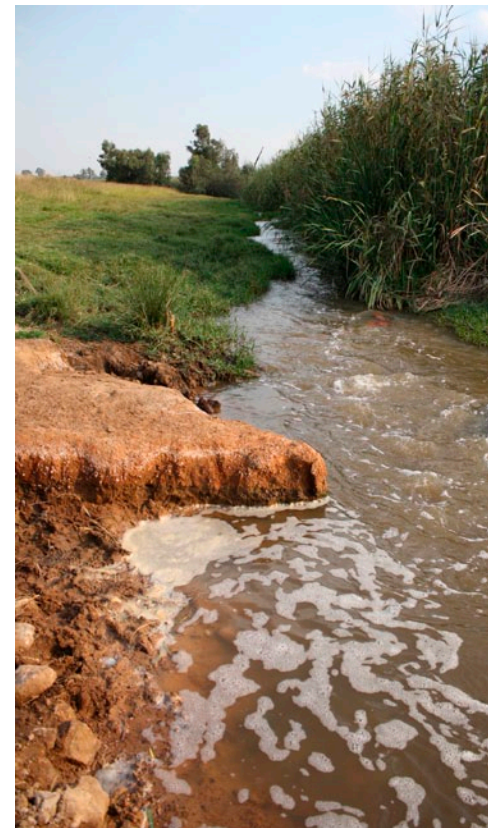
A total of 14 sampling sites were identified in September last year (12 in the Olifants River and two in the Wilge River), and in November the first samples were taken followed by another set of samples taken in March. Senior CSIR researcher



Right: The Upper Olifants River and its tributaries are under the microscope in what is believed to be the biggest investigation of its kind ever to be undertaken in South Africa.

Top left: Inadequately treated sewage flows into the Olifants River when a subsistence fisherman hopes to catch a meal for his family.

Bottom left: CSIR limnologist Dr Paul Oberholster inspects the illegal dumping of industrial chemicals into a stream in the Upper Olifants catchment. This has become so toxic that it contains not even single-celled life forms.



Dr James Dabrowski explains that the sites were selected to be representative of the different types of pollutants entering the Olifants River system. “However, finding a site where only one impact was present proved exceptionally difficult!”

Visiting these sites with the researchers it is not difficult to see why the Olifants River is in such a state. At one site, partly-treated sewage forms a white, bubbly foam in which subsistence fishermen cast their lines. At another, the stench of sulphur from illegally dumped industrial waste is so strong it penetrates one’s clothing and lingers long after one leaves the site. At a third toxic mine-water from an abandoned mine trickles down to a nearby spruit used as a resource by an indigent community.

Apart from standard chemical analysis, the research team is analysing a variety of indicators, including fish, macroinvertebrates, invertebrates, protozoa, phytoplankton, benthic algae and riparian vegetation. Water



Top left: Mpumalanga Tourism and Parks Agency ecologist Jannie Coetzee been a witness to the increased pollution in the Loskop Dam.

Bottom left: Acid mine-water from an abandoned mine flowing into the Brugspruit, ending up in the Olifants River.



samples are also being tested for the presence of endocrine disrupting compounds, bacteria, viruses and pathogens, among others. Samples are also taken back to CSIR headquarters in Pretoria where isotopic studies are performed to indicate the possible accumulation of heavy metals in the fish and invertebrates. In April, a related CSIR health impact study started to determine the potential health impacts of the river water on the communities dependent on its water.

A LOOK AT LOSKOP

The Olifants River Research Project is also tying in with similar CSIR research being undertaken at the Loskop Dam. The dam receives all the water from the upper catchment before it flows further down to the Kruger National Park and eventually Mozambique.

Four sites in the lake are currently sampled regularly.

Oberholster reports that the dam is showing strong signs of becoming hypertrophic. When we visited the dam in March the wall was still overflowing from the recent heavy rains and yet the first signs of algae blooms had already started to appear. The dam experienced its first massive microcystic (blue-green) algae bloom in March 2008.

“Every aquatic system has a relatively limited ability to absorb continual pollutant loads before a dramatic change takes place in the structure and functioning of the ecosystem components,” explains Dr Oberholster. “If an aquatic system consistently moves beyond a critical threshold it is likely to change dramatically and start to behave in a different way, often with unforeseen

Top right: CSIR aquatic scientists Leanie and Arno de Klerk measuring the dissolved oxygen, water temperature, pH and electrical conductivity values at a sampling site.

Bottom right: The CSIR team taking samples on the Loskop Dam.



OLIFANTS RIVER FACTS AND FIGURES

- The catchment of the Olifants River, which rises in the Highveld grasslands, covers about 54 570 km² and is subdivided into nine secondary catchments.
- The Olifants River basin is home to about 10% of South Africa's population.
- More than 55% of South Africa's electricity is produced here.
- About 90% of the country's saleable coal is mined in the Olifants River basin.
- There are more than 200 dams located in the Olifants River basin, 37 of which are major dams (i.e. have a reservoir capacity of more than two million m³). These include Blyderivierspoort Dam, Loskop Dam, Middelburg Dam, Ohrigstad Dam, Phalaborwa Barrage and Witbank Dam. Most of this water is used to irrigate about 110 000 ha.

Source: State of the Rivers Report: Crocodile, Sabie-Sand and Olifants River Systems, 2001

Right: Loskop Dam is showing increasing signs of becoming eutrophic.

Bottom: CSIR aquatic scientist Leanie de Klerk, invertebrate specialist Peter MacMillan and aquatic scientist Arno de Klerk analyse invertebrates found in a section of the Olifants River. The scientists are not only recording the presence and/or absence of species, but also looking at species dominance.



or undesirable consequences for people who rely on the system for water supplies.”

In the case of the Loskop Dam this change can be seen in the more frequent occurrences of algae blooms and massive fish die-offs in the past few years. “This aquatic ecosystem appears to be in a new state where the basic structure and function of the aquatic ecosystem are different from the original conditions that occurred several years ago,” says Dr Oberholster.

needs to find answers. Loskop Dam provides water to the second-largest irrigation scheme in the country. “Many of these farmers currently have lucrative contracts for export and with large retailers. The deteriorating quality of the dam water is certainly a big concern for them,” says Dr Oberholster. “If we do not get this right, and these farmers lose their contracts, 30 000 jobs could be on the line.”

Dr Pat Manders, Executive Director of the National Resources

“It is unfortunate that the one area which is supposed to offer sanctuary to animals and birds is now becoming dangerous to them.”

One man hoping that the research study will make a difference is Mpumalanga Tourism and Parks Agency ecologist Jannie Coetzee. Over the last few years he has witnessed the demise of the crocodile and hinged terrapin population around the dam. Coetzee explains that the dam seems mostly affected at the inlet, ironically the area which has been cordoned off as the wildlife zone of the dam. “It is unfortunate that the one area which is supposed to offer sanctuary to animals and birds is now becoming dangerous to them.”

It is not only for the sake of the environment that the research team

& the Environment division at CSIR, believes this study could be replicated in other catchments around the country. “The challenges we face in the Olifants River catchment occur in catchments all over South Africa. However, we currently have a situation where we lack the detailed understanding in order to deal with these challenges effectively. Studies such as the Olifants River Research Project will become increasingly important in the future.”

The team expects to have preliminary findings by the end of this year. It is hoped that the answers will be found before it is too late. □

